# POWER

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**JUNE 1947**

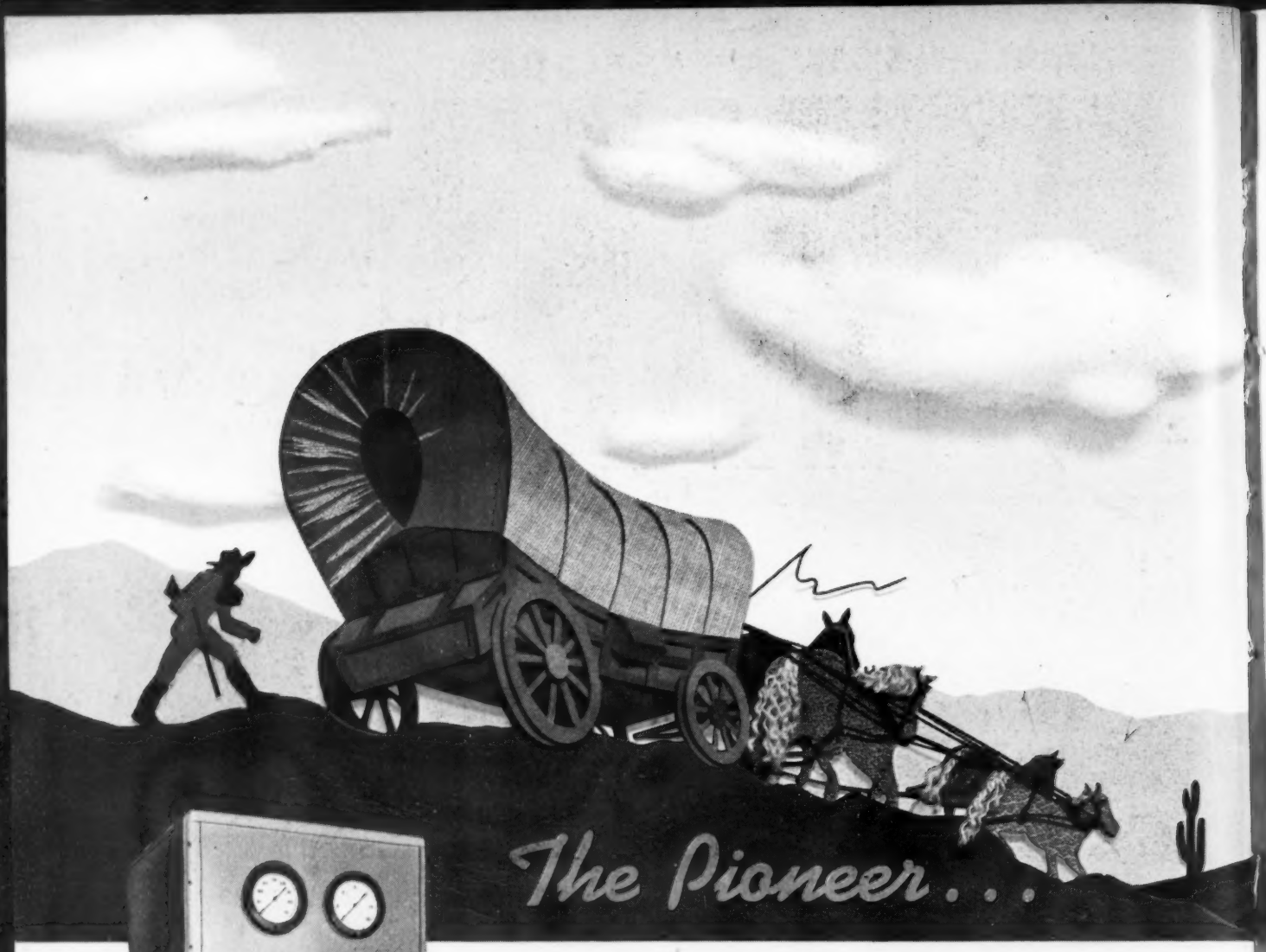
A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

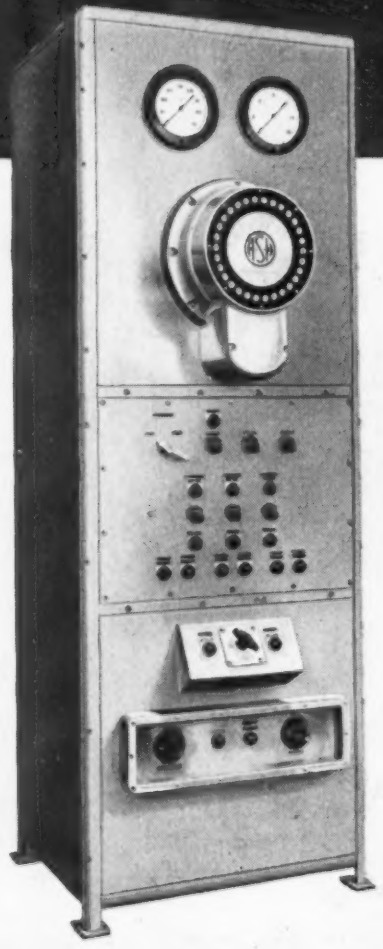
*IN THIS ISSUE:*

## MODERN PLANT SURVEY

**Technical data on typical steam and hydro units installed since June, 1946**

TABLE OF CONTENTS, PAGE 59



## AUTOMATIC DUST HANDLING SYSTEM

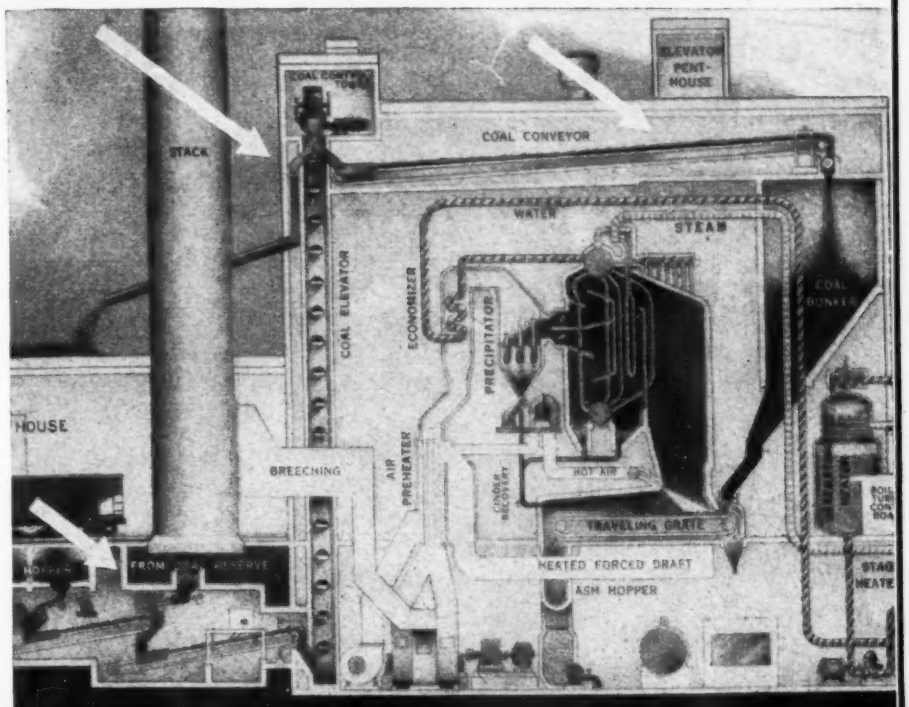
# ...HYDROVAC

Our trek into the unexplored unknown of automatic dust handling began over ten years ago. We sought the ultimate . . . a system that seemingly "thinks for itself" . . . one with the uncanny reliability that is foolproof. . . . Success, in rewarding our pioneering quest, has uncovered a surprise economy bonanza because "time has more effect on wear than tonnage." Continuous, top-speed operation of automatic dust removal reduces all maintenance, particularly pipeline. . . . The **Automatic Sequence Head** (pictured at left, patents pending) is, as its name implies, the head or brain controlling this Hydrovac System. It opens and closes dust valves, skips over boilers off the line, warns of unusual conditions, tells what is happening all the time, and closes the system when all dust is removed. . . . Get the complete story from our representative, then you'll agree it's more than a sound investment. . . . The Allen-Sherman-Hoff Company, 227 S. 15th Street, Philadelphia 2, Pa.

**AUTOMATIC AUTOMATIC ALLEN** **SEQUENCE SEQUENCE SHERMAN** **HYDROVAC HEAD HOFF**

**POWER** (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), June, 1947, Vol. 91, No. 6, Published monthly with additional Directory in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 N. Broadway, Albany 1, N.Y. Editorial and executive offices, 330 W. 42nd St., New York N.Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Allow at least 10 days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 W. 42nd St., New York 18, N.Y. Subscription rates, U.S. and U.S. possessions, $5 for one year, $8 for two years. 50c per single copy. Canada, $6 for one year, $9 for two years. Pan American countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years

# CUTTING COSTS WITH CONVEYORS •




## *Conveyor-elevator system solves unusual problem at central station*

● Here's the perfect "doubles" team for power plant materials handling: Link-Belt experience in designing thousands of handling systems for highest efficiency . . . and Link-Belt standard-unit equipment for low first cost and minimum maintenance.

At the Jennison steam-electric generating station of the New York State Electric & Gas Corp., Bainbridge, N. Y. (Gilbert Associates, Inc., Consulting Engineers), the problem was that of handling an abrasive type of coal (No. 4 washed buckwheat anthracite) automatically from R. R. cars to overhead bunkers or reserve, or from reserve to bunkers—at 100 tons per hour.

As shown in illustration above, the integrated Link-Belt handling equipment consists of: 4 reciprocating feeders under track hopper openings, delivering to No. 1 belt conveyor. No. 2 belt conveyor receives coal from No. 1 belt conveyor or reserve storage. A vertical bucket elevator with two-way chute discharges to storage or to No. 3 belt conveyor, as needed. The No. 3 unit discharges to a screw conveyor that takes the coal to the bunkers.

Would you like to have more details on this and other installations? Get in touch with our nearest office.

**LINK-BELT COMPANY**

10,816

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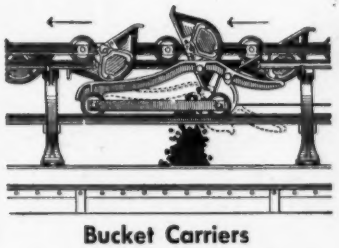
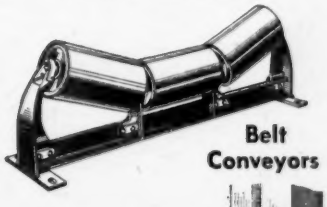
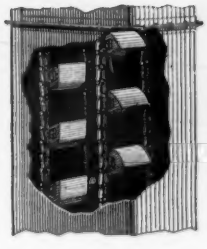
**COAL AND ASHES HANDLING EQUIPMENT**

## LINK-BELT EQUIPMENT

### Meets Every Need of Industry in Handling Materials


Bucket Carriers

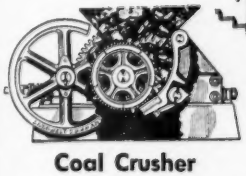

Belt Conveyors

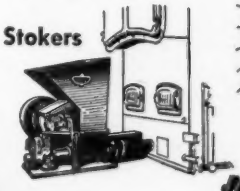

Bucket Elevators

Bulk-Flo

Screw Conveyor

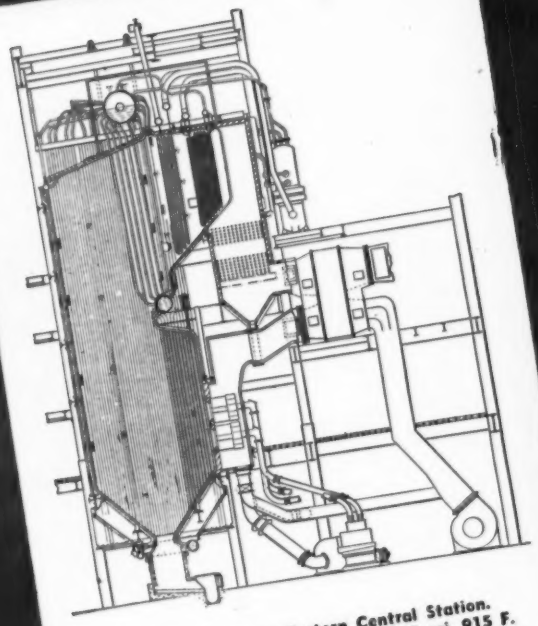
Skip Hoist


Coal Crusher


Stokers

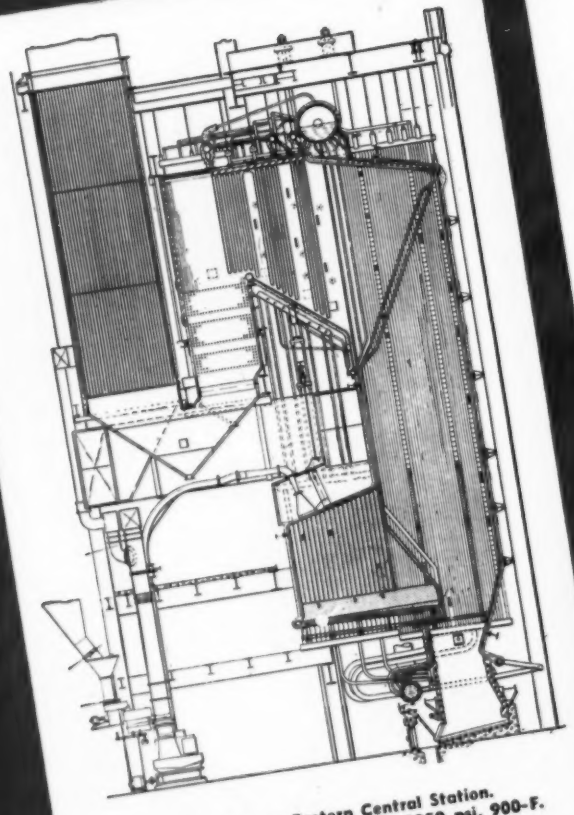
Car Dumper

Weigh Larry

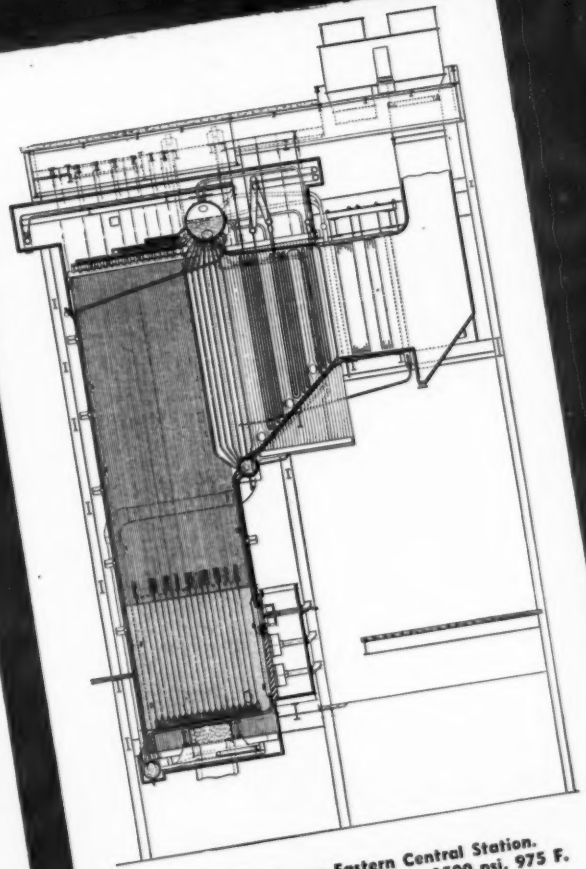


Radiant Boiler in an Eastern Central Station.
Capacity—550,000 lb. per hr. at 900 psi, 915 F.

*ae*



Radiant Boiler in an Eastern Central Station.
Capacity—900,000 lb. per hr. at 1250 psi, 900-F.

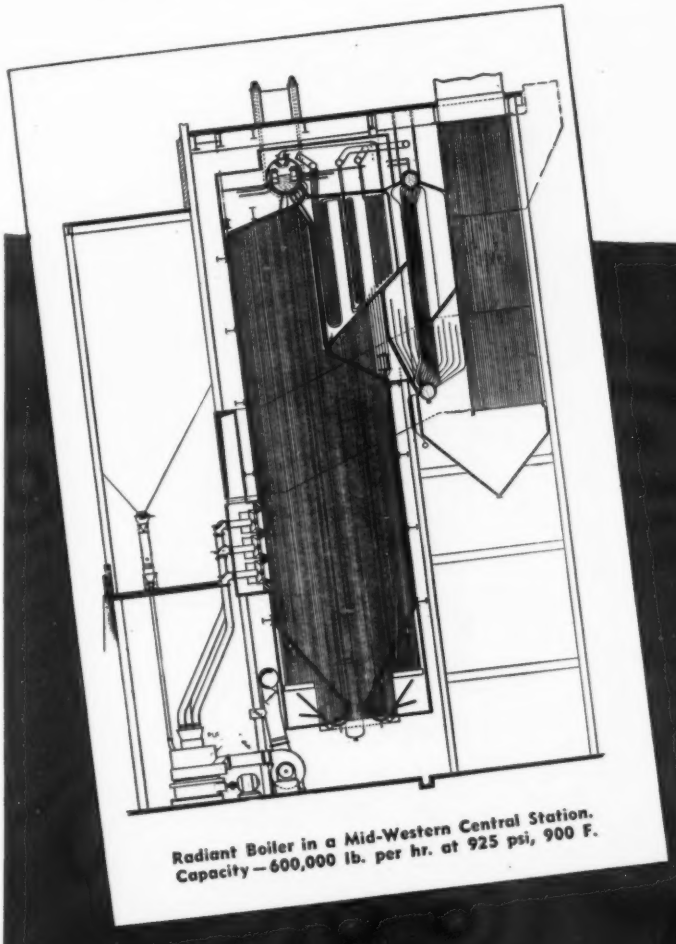


Radiant Boiler for an Eastern Central Station.
Capacity—900,000 lb. per hr. at 1500 psi, 975 F.

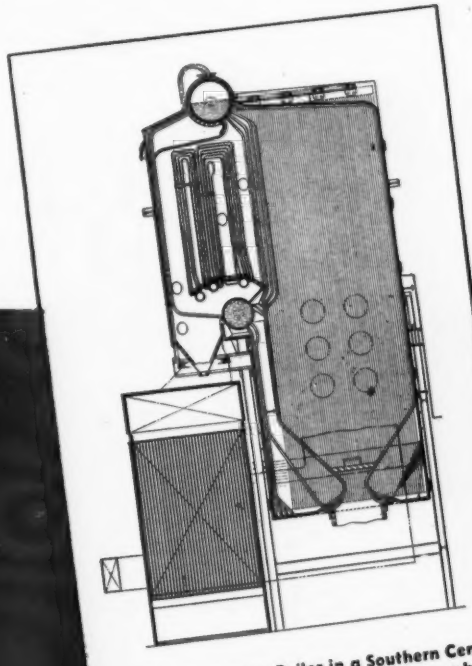
# MATCHED TO MODERN NEEDS

IN modern Open-Pass, Radiant, Stirling, and Integral-Furnace Boilers, B&W is providing the central-station industry with time-tested, performance-proved designs for low-cost steam generation over the entire range of present-day requirements. Long, satisfactory experience with these types reflects their high standards of performance as to continuity of service, dependability, overall operating efficiency, adaptability to all types of fuels, and greatest return on investment.

B&W experience in matching boilers to jobs for utmost efficiency and economy covers three times twenty-five years and more. Such experience cannot be written into specifications or shown on blueprints but it is a part of all modern B&W boilers that is contributing to low-cost power production.



Radiant Boiler in a Mid-Western Central Station. Capacity—600,000 lb. per hr. at 925 psi, 900 F.



Integral-Furnace Boiler in a Southern Central Station. Capacity—300,000 lb. per hr. at 1000 psi, 910 F. Oil fired with provision for future pulverized-coal firing.

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### ADDING VALUES TO A TURBINE LINE OF PROVED CAPABILITY

Sturdy reliability has always been the prime characteristic of Elliott turbines for mechanical drive. In the new "YR" line, design features responsible for this quality are retained, with the addition of the features below, and the benefits accompanying the standardizing of the entire line.

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- SIX GOVERNORS applicable to any turbine in the line.
- EIGHT TURBINE TYPES on five frame sizes.
- EXTREME FLEXIBILITY obtained with a number of standardized modifications.

**THE MANY EXCLUSIVE FEATURES** in YR turbines—too many to be listed here—justify their examination by all engineers with mechanical drive problems. Your request brings a copy of the YR Turbine Bulletin.

H-707

**COMPANY** *Steam Turbine Department* JEANNETTE, PA.

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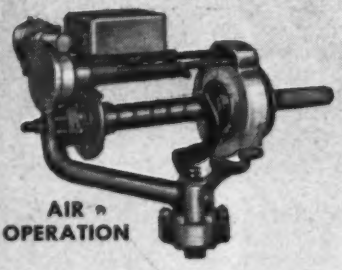
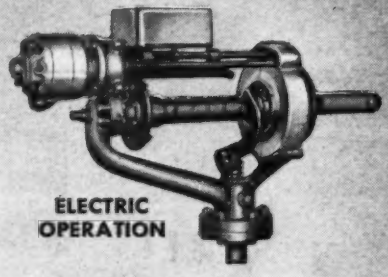
# *Efficient* BOILER OPERATION

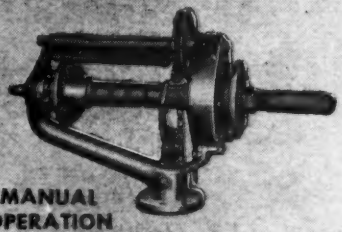
## DIAMOND Model IR Short Retracting Soot Blowers



AIR OPERATION



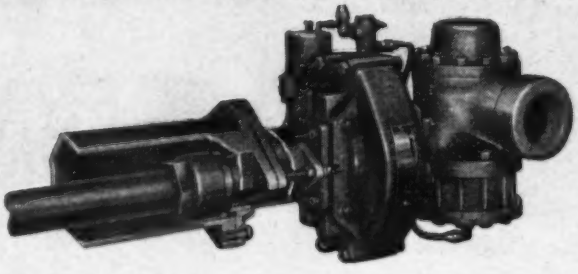
ELECTRIC OPERATION



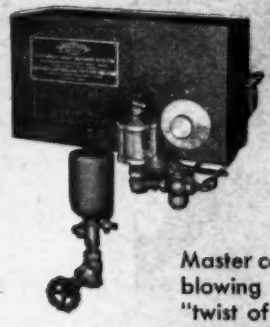
MANUAL OPERATION

For cleaning either furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Equally applicable to compressed air or steam as cleaning medium. Important advantages include: positive poppet type valve, 12" travel, no lubrication, 360° blowing without additional advance of nozzle, simple, etc.

## DIAMOND Model A2E Automatic Air Puff Soot Blowers

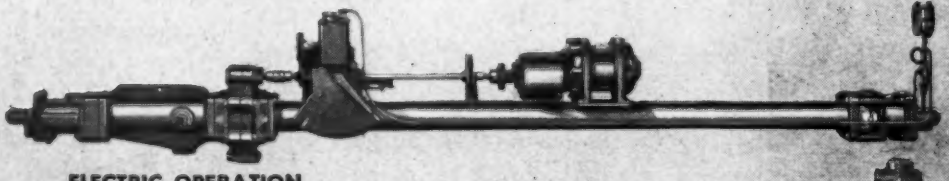


Cleans heating surfaces by series of compressed air puffs delivered through standard multiple nozzle blowing element. Spreading cleaning cycle over longer time permits smaller compressor and receiver . . . also eliminates stack discharge nuisance.

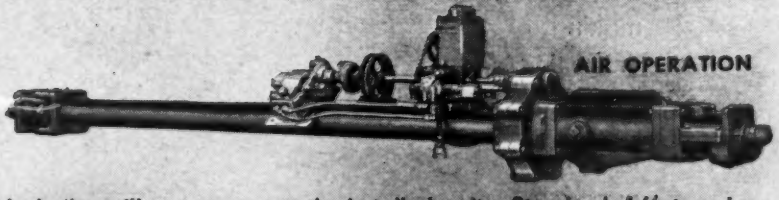


Master controller automatically controls blowing time and sequence. Just a "twist of the wrist" to open valve . . . controller does rest. Automatic control assures correct boiler cleaning.

## DIAMOND Telescopic Retracting Soot Blowers



ELECTRIC OPERATION



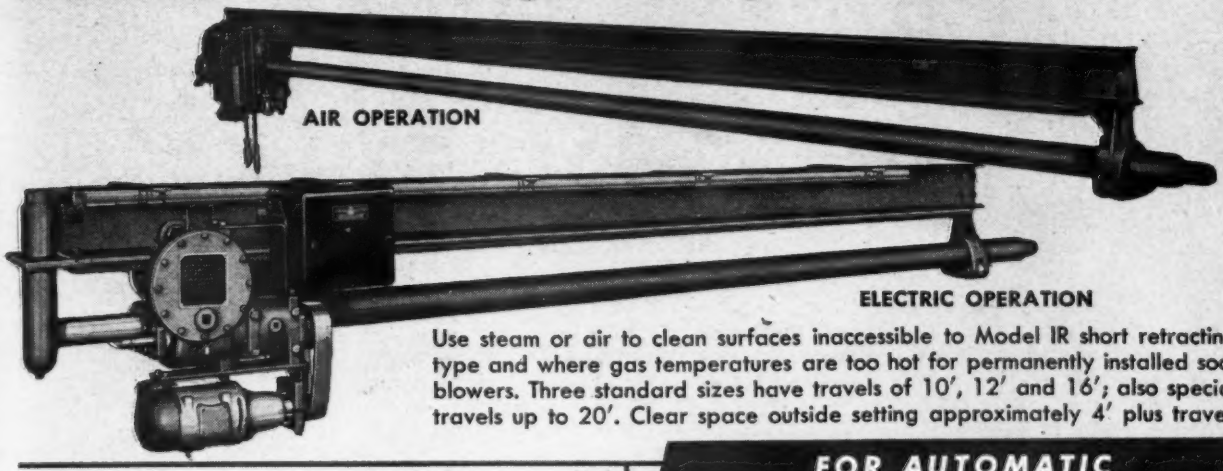
AIR OPERATION

Used where insufficient clear space outside boiler will not permit installation of Model IK retracting blower for cleaning surfaces inaccessible to short retracting blower and where gas temperatures are too hot for permanently installed units. Standard 16' travel requires approximately 12' clear space outside boiler; special travels up to 20'. Uses air or steam as cleaning medium.

**DIAMOND POWER SPECIALTY CORP.**

# REQUIRES THE SELECTION OF SOOT BLOWERS THAT EXACTLY SUIT YOUR INDIVIDUAL REQUIREMENTS

## DIAMOND Model IK Long Retracting Soot Blowers

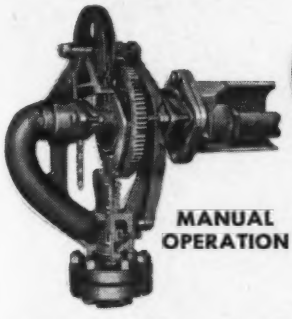


AIR OPERATION

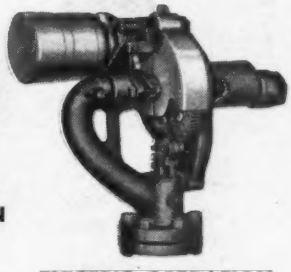
ELECTRIC OPERATION

Use steam or air to clean surfaces inaccessible to Model IR short retracting type and where gas temperatures are too hot for permanently installed soot blowers. Three standard sizes have travels of 10′, 12′ and 16′; also special travels up to 20′. Clear space outside setting approximately 4′ plus travel.

## DIAMOND Model G9B Soot Blower

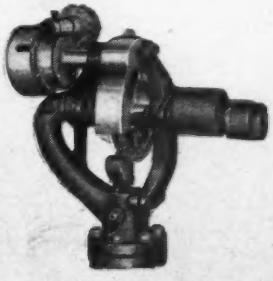


MANUAL OPERATION



ELECTRIC OPERATION

Uses steam as cleaning medium through multiple nozzle blowing element permanently installed inside setting. "Automatic Valved" requiring only one continuous operation to open and close valve in head and simultaneously rotate element. Other important features: adjustable pressure control unit, clockwise or counterclockwise rotation, 360° blowing arc, etc.

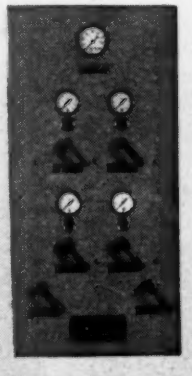


AIR OPERATION

## FOR AUTOMATIC SEQUENTIAL SOOT BLOWING

Correct cleaning is always assured and labor is saved. "Human element" is eliminated as operator normally only presses start button or opens master control valve. Each blower unit must operate in correct sequence and at right speed every time. No blower can be overlooked or incorrectly operated. Labor is saved because no need for attendant to warm up piping, drain it, and then operate each blower unit manually. Blower grouping can sectionalize heating surface into zones to maintain normal heat absorption by different frequency of group operation. System can be completely air or electric operated and controlled . . . or combination of both.

DIAMOND ELECTRIC CONTROL PANEL



DIAMOND AIR CONTROL PANEL

# DIAMOND SOOT BLOWERS . . . *the Most Complete Line*

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# HOW BAILEY CONTROLS INCREASE SAFETY

## SAFE BOILER OPERATION

### EXPLOSION HAZARDS REDUCED

**1.** Automatic Readjustment of fuel-air ratio insures proper mixture for safe efficient combustion.

**2.** Limit stops and accurate draft control protects against loss of ignition at low ratings.

**3.** Interlocks may be provided to trip out equipment upon failure of related units.

**4.** Purge interlocks insure safety in lighting-off.

### OPERATORS FREE TO ACT

In emergencies control automatically carries on leaving the operating personnel free to concentrate on the cause of the emergency.

### SAFE STEAM TEMPERATURE

Prime movers, superheaters, valves and piping are protected against excessive steam temperatures by superheat control.

### NORMAL WATER LEVEL

Damage to turbines from water carry-over and to boiler tubes from low water is avoided by effective feed water control.

### BOILER FEED PUMPS

Automatic by-pass control protects feed pumps at low rates of flow.

### IN YOUR PLANT

There may be applications where Bailey Controls will improve safety, lower fuel and maintenance costs, and enable you to render better power service.

Call on your local Bailey engineer to make recommendations or write for Bulletin 15-C which describes Bailey Controls for Steam Plants. Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio. In Canada—Bailey Meter Company Limited, Montreal.

A-93

## BAILEY METER COMPANY

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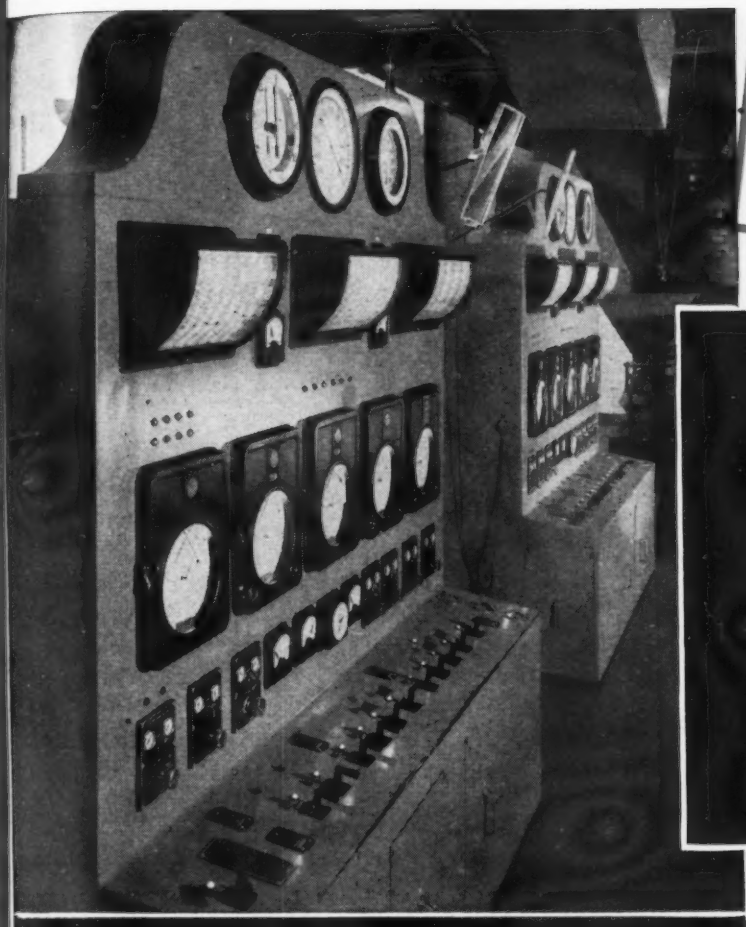
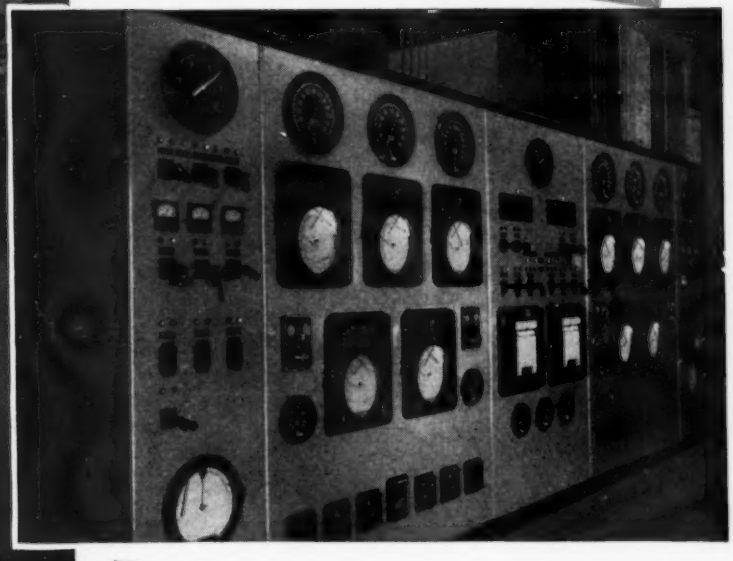
*Controls for Steam Plants*

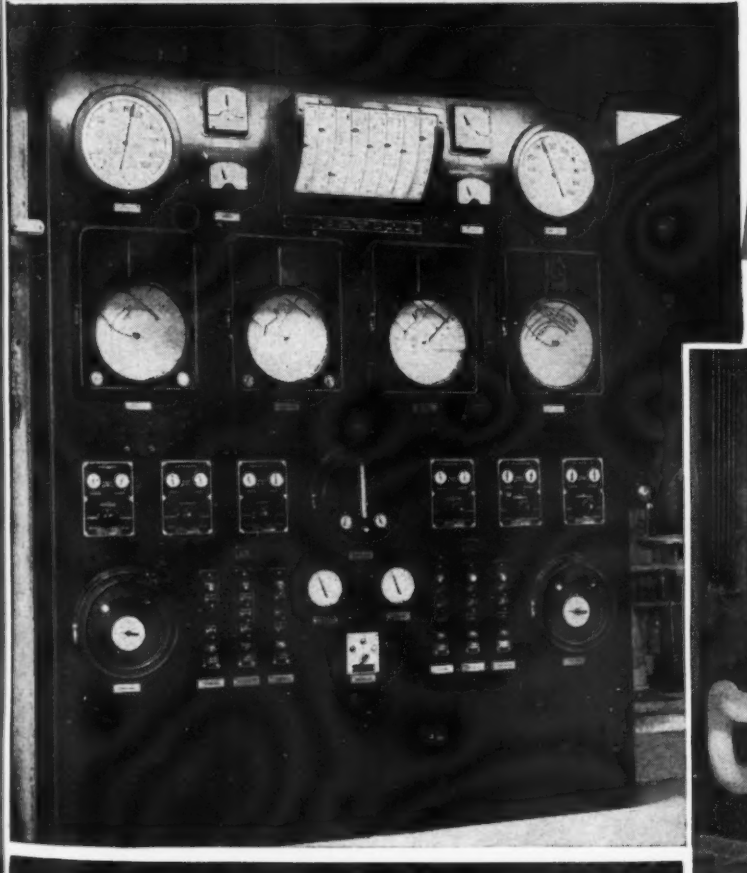
COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS



**LEFT:** Combustion Control, Three-element Feed Water Control and Superheated Steam Temperature Control for two 375,000 pound per hour pulverized coal fired boilers are coordinated on these Bailey Boiler Panels to insure safety and economy.

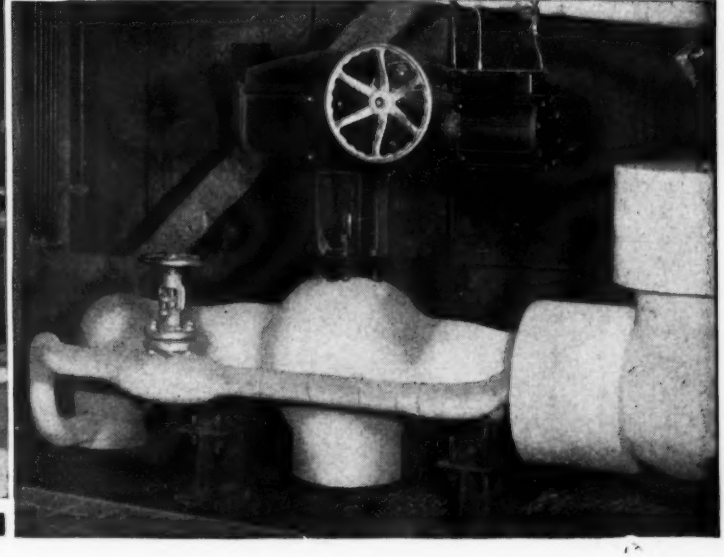
**BELOW:** Hotwell and Heater Levels in the Feed Water System for two 800,000 pound per hour pulverized coal fired boilers are automatically maintained at design values by this Bailey Pump Control Panel.





**LEFT:** This Bailey Control Panel in a synthetic rubber power plant provides for the use of waste gas as an auxiliary boiler fuel when and as it is available. Interlocks and fuel-air ratio controls insure safe operation.

**BELOW:** This 8-inch Bailey Three-element Feed Water Control Valve regulates water input to equal steam output from a 700,000 pound per hour boiler, thereby maintaining a safe water level in the drum at all times.



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WHATEVER the type or size of your Diesel, there is a *Texaco Ursa Oil* that will bring you all the benefits listed on the opposite page—assure peak performance at the lowest possible cost for fuel and maintenance.

*Texaco Ursa Oils* keep engines clean, powerful and smooth-running. They prevent formation of carbon and sludge — keep rings free, valves active, ports clear. They prolong the life of bearings, pistons, rings and liners — give you extra hundreds of hours of efficient, economical performance between overhauls.

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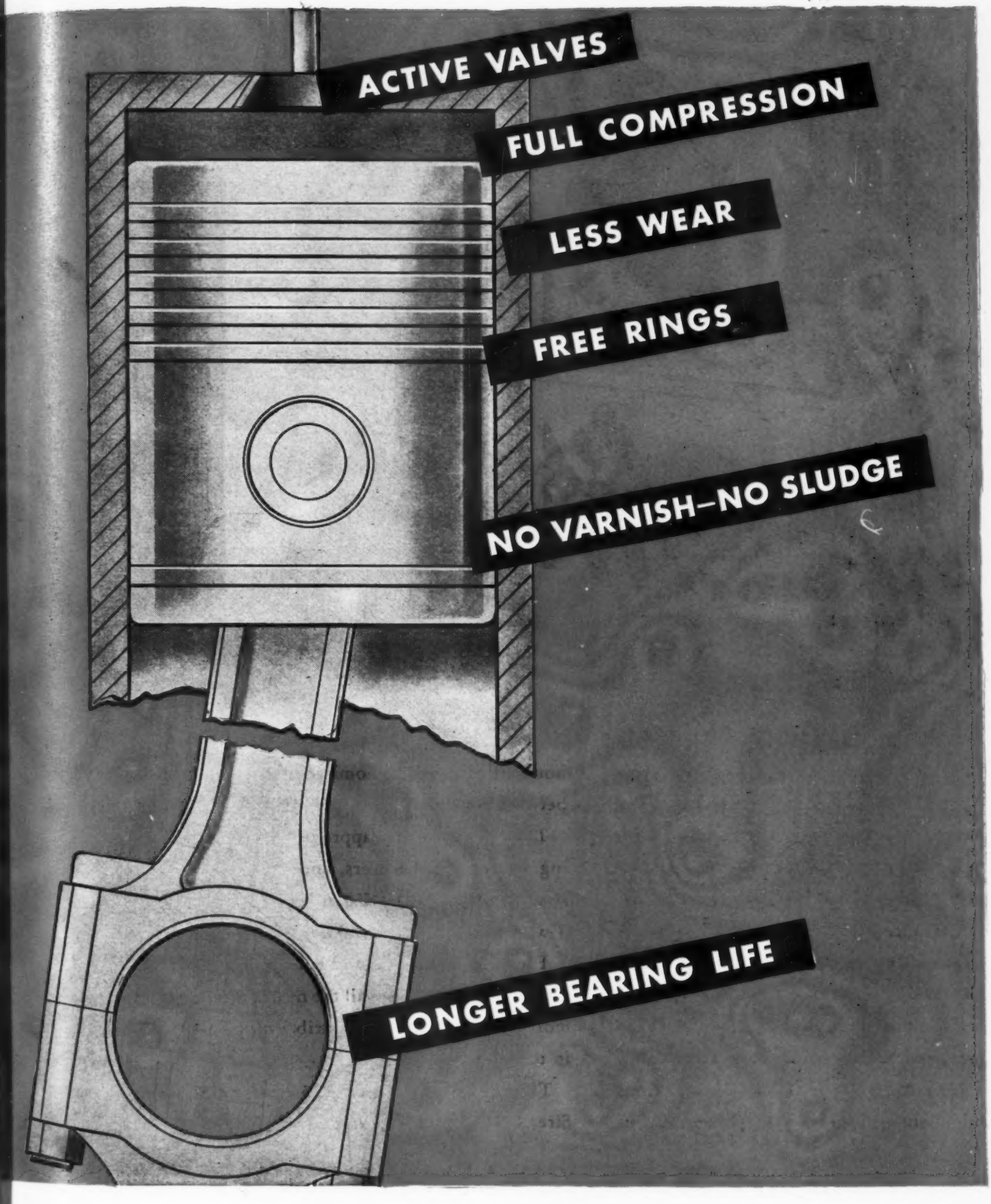
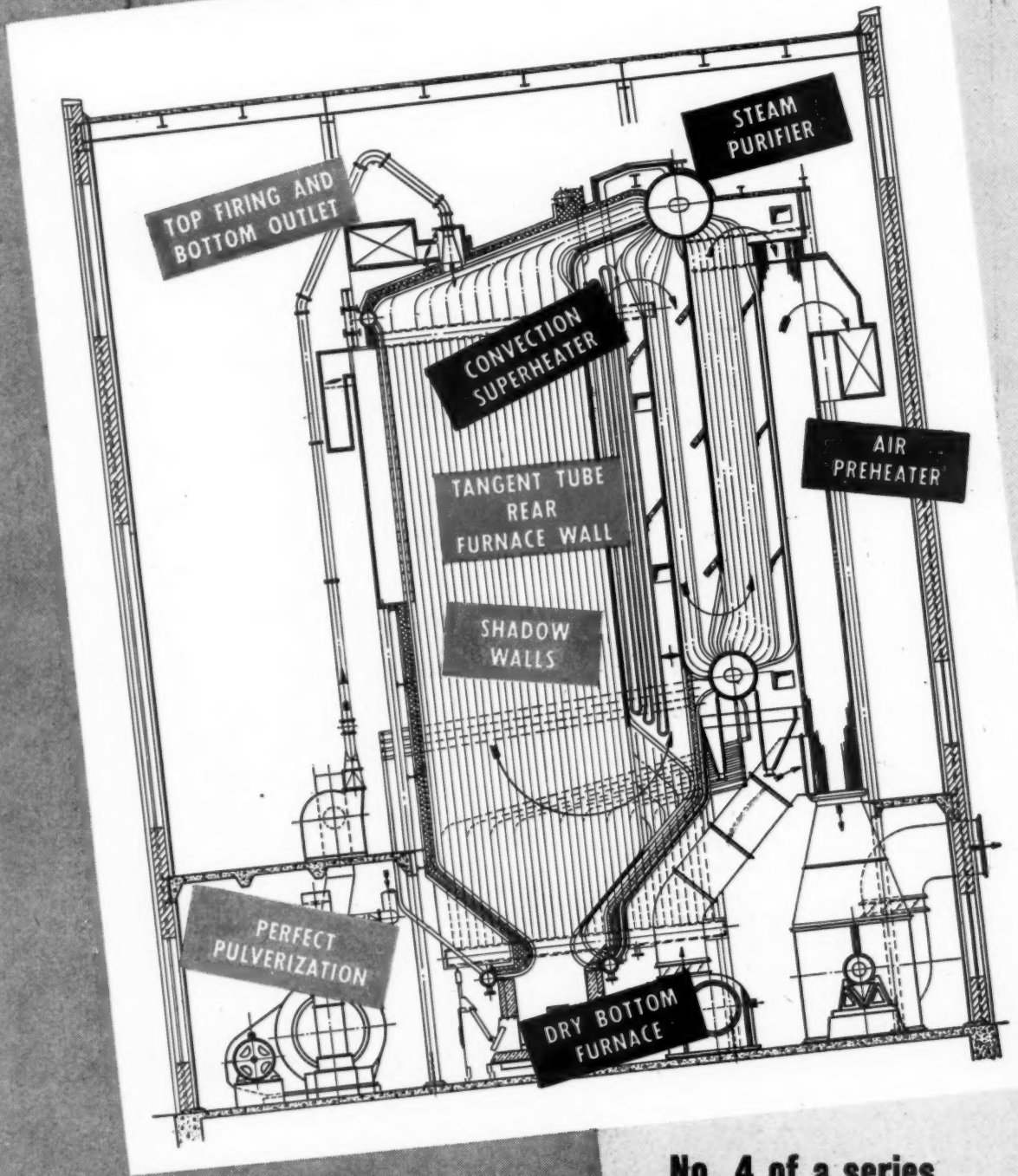



# URSA OILS

FOR ALL DIESEL ENGINES

# KVS ENGINEERED




**No. 4 of a series**

See May "POWER" for description of COAL BURNER

# RADIANT HEAT

## provides high radiation rate and decreased convection boiler surfaces

Tangent tube rear furnace wall in combination with shadow walls eliminates refractory maintenance between furnace and superheater pass.

This construction permits higher furnace temperatures resulting in greater radiant heat transfer and increased furnace efficiency.

This type of rear wall is a "must" in modern furnace design where low heat release, low fusion temperatures and high ash content coals are to be used. These factors are dependent on superfine pulverization and complete carburization of the fuel.

Large furnace wall headers and increased water supply are required with these higher furnace temperatures to insure maximum steam output without endangering the furnace tubes.

These and all other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK · USA · MFG. & ENG. CORP.

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MANUFACTURING AND ENGINEERING CORPORATION

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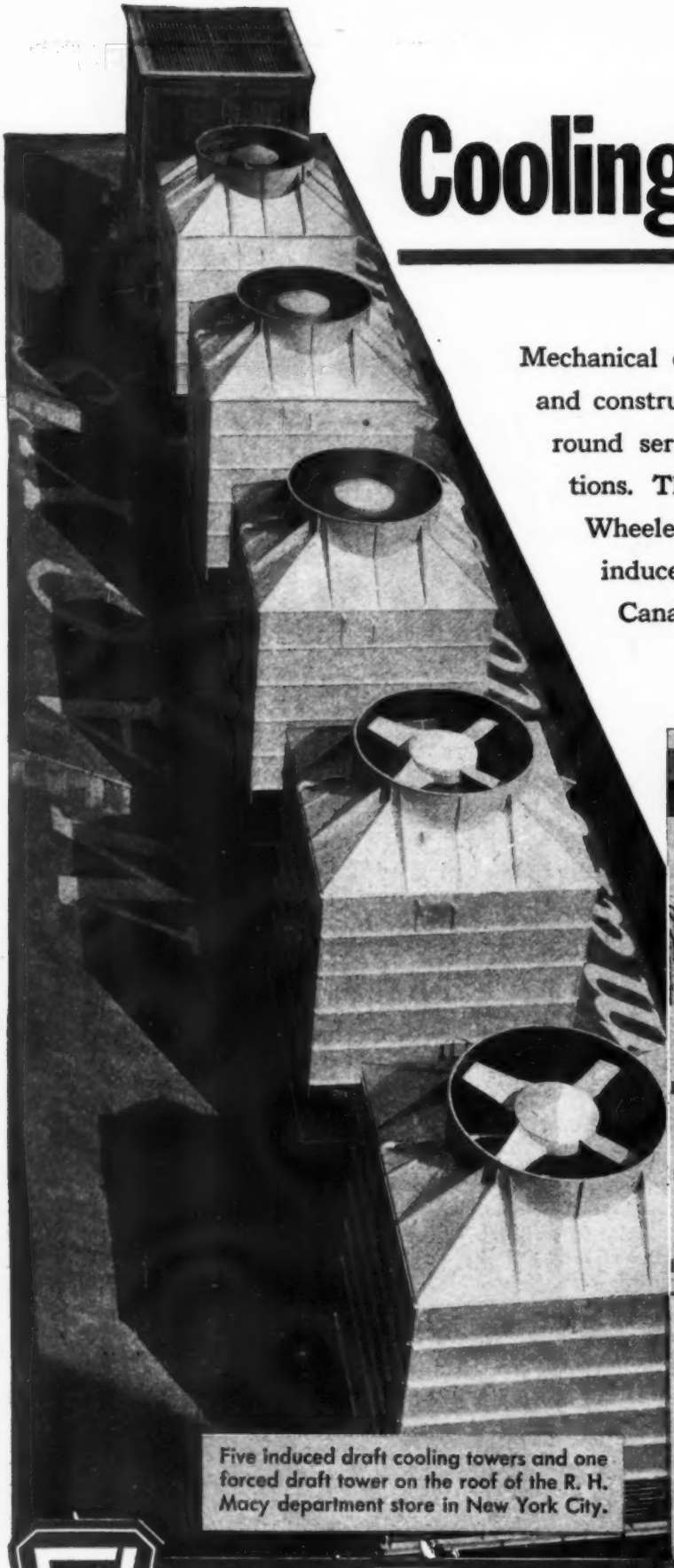
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

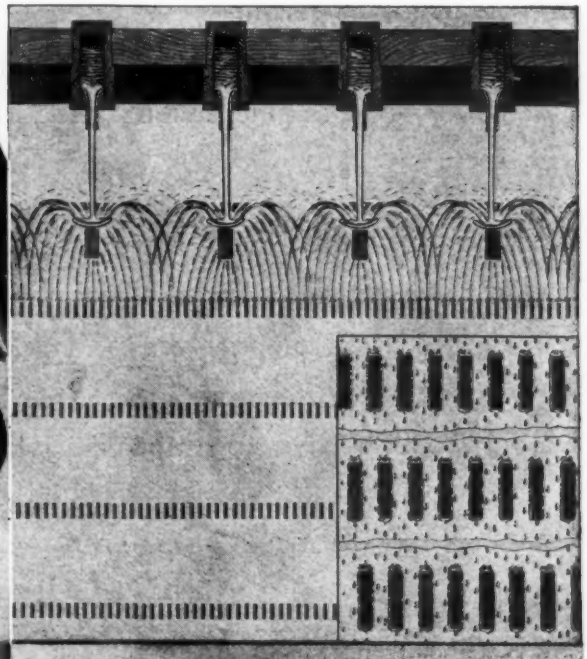
CANADA • ENGLAND • FRANCE • AUSTRALIA

# Cooling Towers and

Mechanical draft cooling towers, properly designed and constructed, will deliver full capacity in year-round service irrespective of atmospheric conditions. The wide experience gained by Foster Wheeler engineers in developing forced and induced draft cooling towers now serving from Canada to India insures highest performance.



Five induced draft cooling towers and one forced draft tower on the roof of the R. H. Macy department store in New York City.



**WATER DISTRIBUTION and TOWER FILLING**

The modern system of water distribution is from troughs, the water falling through nozzles upon splash plates. These plates throw an even spray of drops over the whole area of the tower. The drops then fall upon wood slat filling, which presents a large wetted surface and retards their fall to effect extreme air-water contact in the counter-current air flow.

FW FOSTER

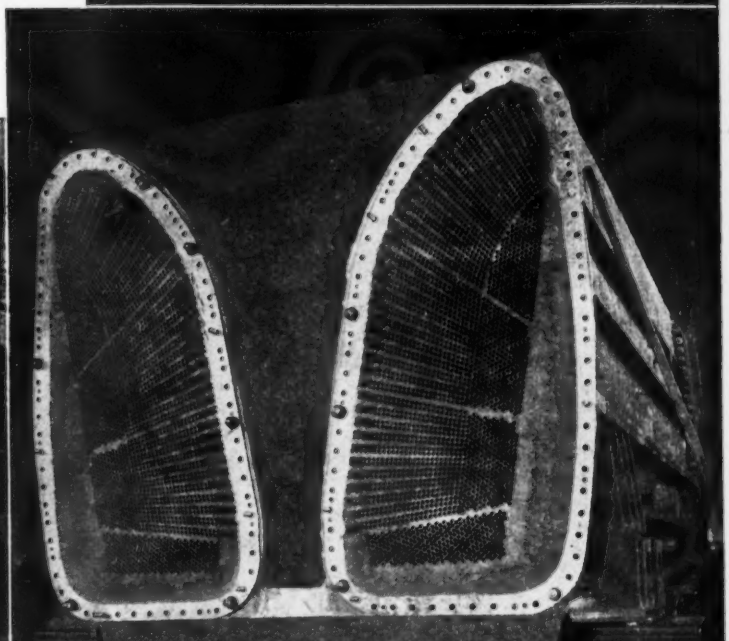
# Condensing Equipment

Condensers built by Foster Wheeler have evolved from those built by pioneer manufacturers in the United States. They serve today in some of the most efficient utility and power plants in the country. Foster Wheeler also manufactures a complete line of highly developed auxiliaries to assure top efficiency. Auxiliaries include steam jet vacuum pumps, condensate pumps and circulating pumps of centrifugal and axial flow design.

**FOSTER WHEELER CORPORATION**
**165 Broadway, New York 6, New York**

Shop assembly picture of a 34,500 sq. ft. single pass, cross flow type condenser, showing internal baffles, tube support plates and structural members.

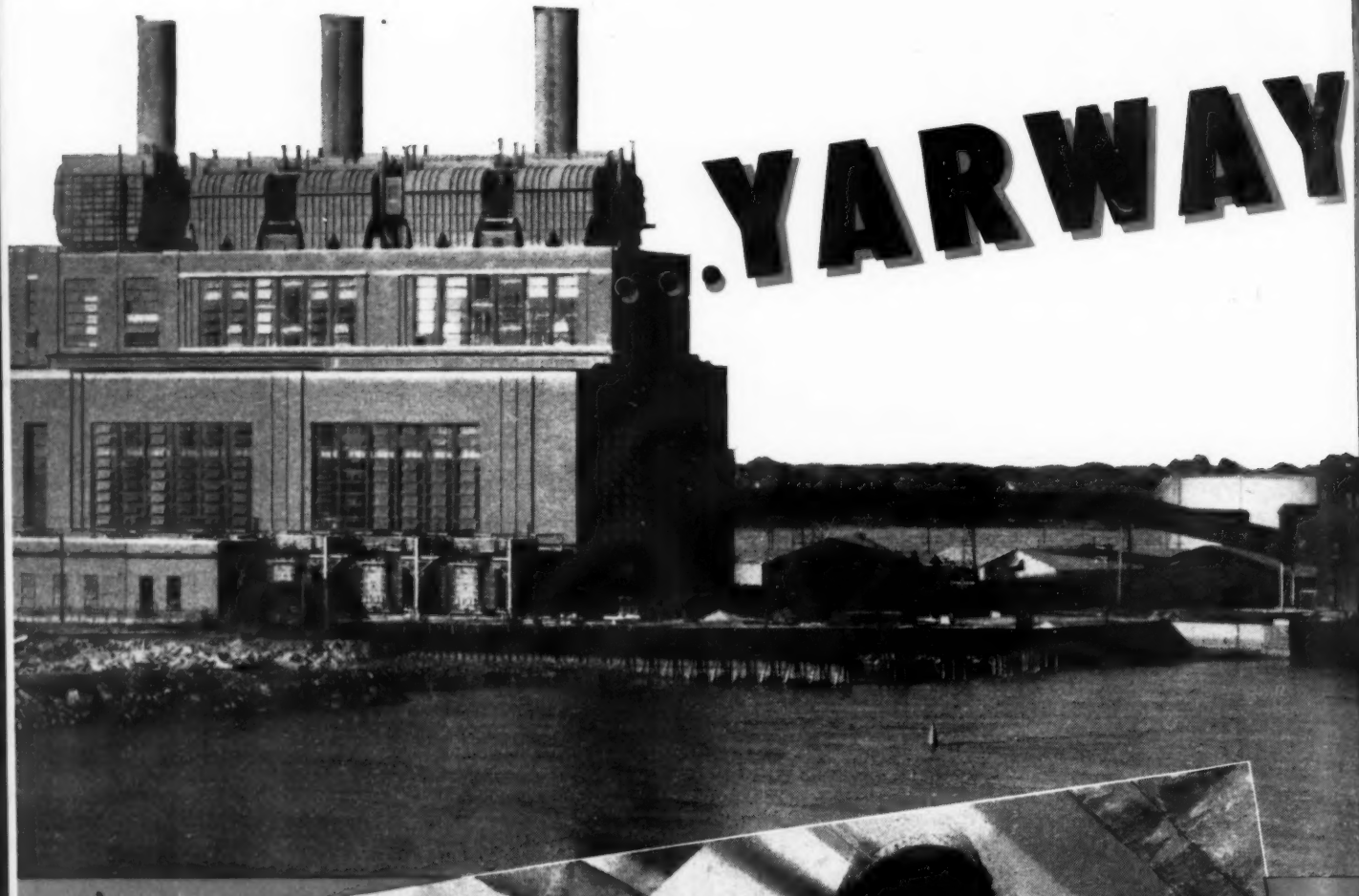
Drilling tube sheets in the Carteret shops. Two sheets are drilled at the same time.

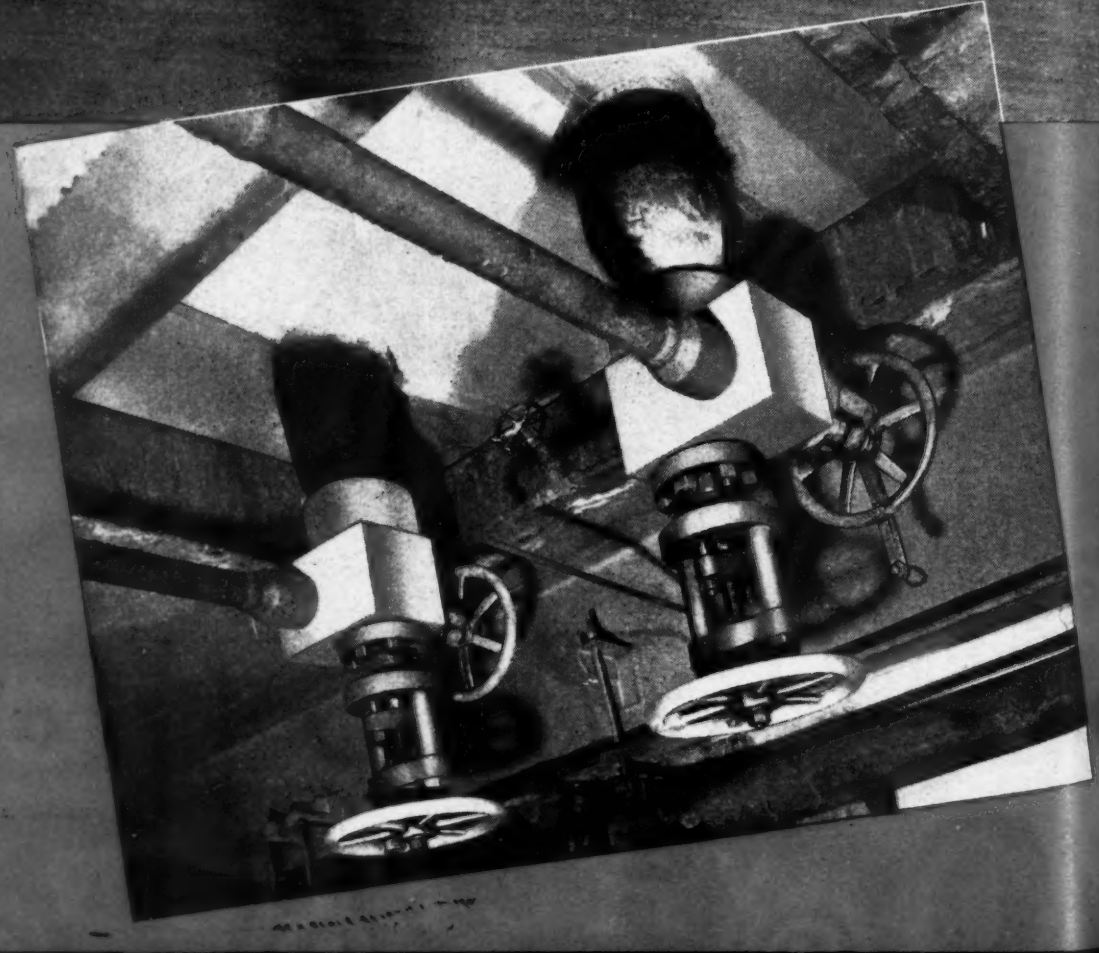


The same condenser with tube sheets in place. Arrangement of tubes indicates the short steam lanes used in each tube bank of a low headroom design.

WHEELER

# Public Service (N.J.) *Chooses* YARWAY





Burlington, N. J., Station of the Public Service Electric and Gas Company. Four boilers at this plant, and two at Public Service's Marion Station are each equipped with two Yarway Unit Tandems. Steam pressure boiler 1350 psi, turbine 1250 psi. Temperature 950° F. Output, each boiler, 550,000 lbs per hour; high pressure turbines, 125,000 KW each.

YARWAY BLOW-OFF VALVES

# UNIT TANDEMS

## FOR HIGH PRESSURE BLOW-DOWN SERVICE

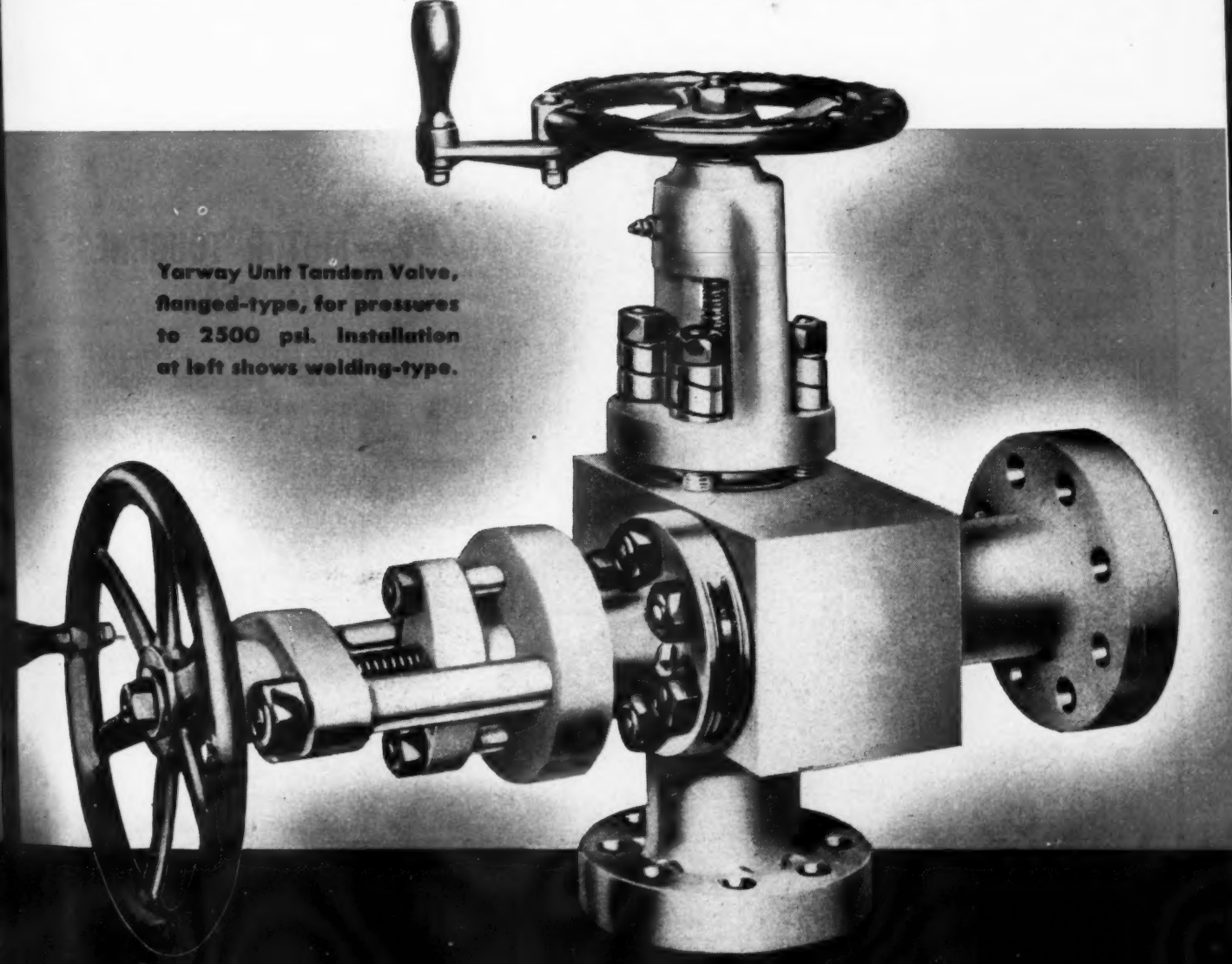
Why has the Public Service Electric and Gas Company of New Jersey, like so many other leading utilities, selected Yarway Unit Tandem Blow-Off Valves for their high pressure boilers? The answer is simple—*proved performance.*

Yarway Unit Tandems have proved themselves unequalled in service throughout all industries on pressures from 400 to 2500 psi. This tandem is a combination of the Yarway Hard-Seat* Valve (next to boiler for blowing) and the famous Yarway Seatless Valve (for sealing)—both contained in a one-piece forged steel body. This rugged construction eliminates the interconnecting flanges, bolts and gaskets required in bolted tandem designs, making a trim, compact unit.

Nearly 40 years of laboratory and field experience concentrated on blow-off valve requirements, makes Yarway a logical source of supply for your next blow-off valves. Write for Catalog B-432 for pressures up to 2500 psi . . . Catalog B-424 for lower pressures.

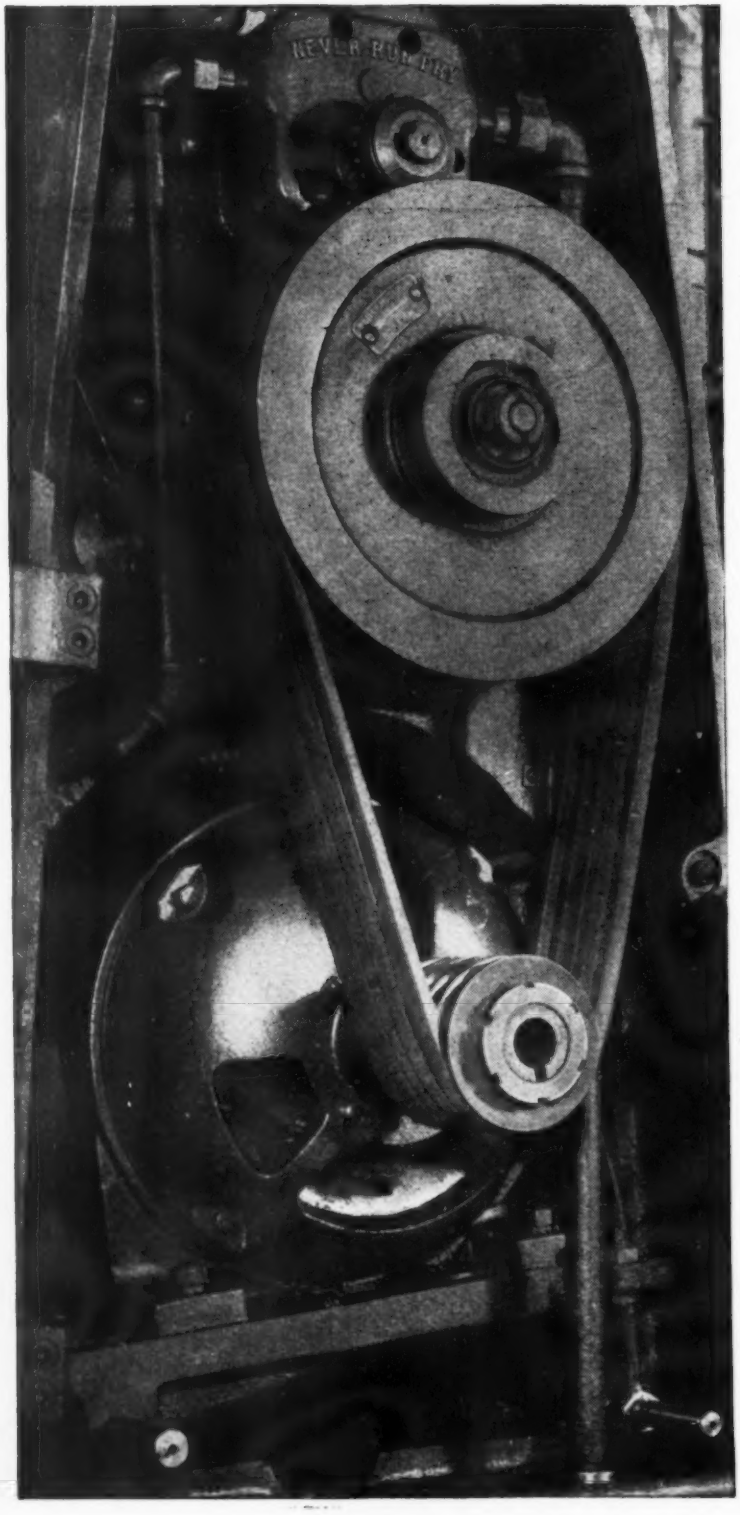
** Seats furnished either separate or integral.*

**YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.**



**Yarway Unit Tandem Valve, flanged-type, for pressures to 2500 psi. Installation at left shows welding-type.**

# 5 BILLION



## FIVE YEARS IN "SOLITARY"!

Many machine tools in the Bell Aircraft plant at Buffalo have pioneer Tri-Clad motors tucked away inside. The result is a sleek exterior for the machine and valuable floor space saved. During the war, when time was short and uninterrupted production was of utmost importance, these motors gave dependable service, demanding only a minimum of lubrication and inspection.

The Tri-Clad motor you see here driving a milling machine has not been removed for five years. Operating in confined quarters, where the volume of cooling air was limited (and laden with oil), it has done its job faithfully, despite the strain of a 3-shift, 7-day work schedule. Thanks to the extra protection built into this and the more than 200 other Tri-Clad motors in the Bell plant, they give every sign of staying on the job indefinitely.

## *Now*— MOTOR TOUGHNESS AT ITS PEAK

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres — in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this motor gives you these important construction features:

- **A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.**
- **A nonshrinking compound around motor leads which protects motor interior from dust and moisture.**
- **A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.**

# MOTOR HOURS

## PROVE YOU CAN'T BEAT

## TRI/CLAD

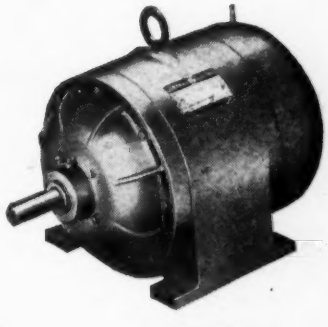
# EXTRA PROTECTION

Since 1941, nearly a million Tri-Clad motors have been purchased by American industry.

Figured conservatively, they have delivered more than 5 billion hours of service — most of this service under war-time conditions when maintenance was infrequent and overloads were the rule.

This Tri-Clad motor record for continuous service under adverse conditions is the best proof we can give you that these motors have *even better protection* than we promised.

Remember, the Tri-Clad motor family now includes dripproof, totally enclosed, vertical, gear, and capacitor-motors. All of these types, we believe, offer you a combination of performance characteristics, horsepower-per-frame-size, and protective features that no other line of general-purpose motors can match. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



### *EXTRA PROTECTION* . . . AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital motor parts from external abuse and also prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

### *EXTRA PROTECTION* . . . AGAINST ELECTRICAL BREAKDOWN!

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years!

### *EXTRA PROTECTION* . . . AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

**Trade-mark reg. U. S. Pat. Off.*

**GENERAL ELECTRIC**

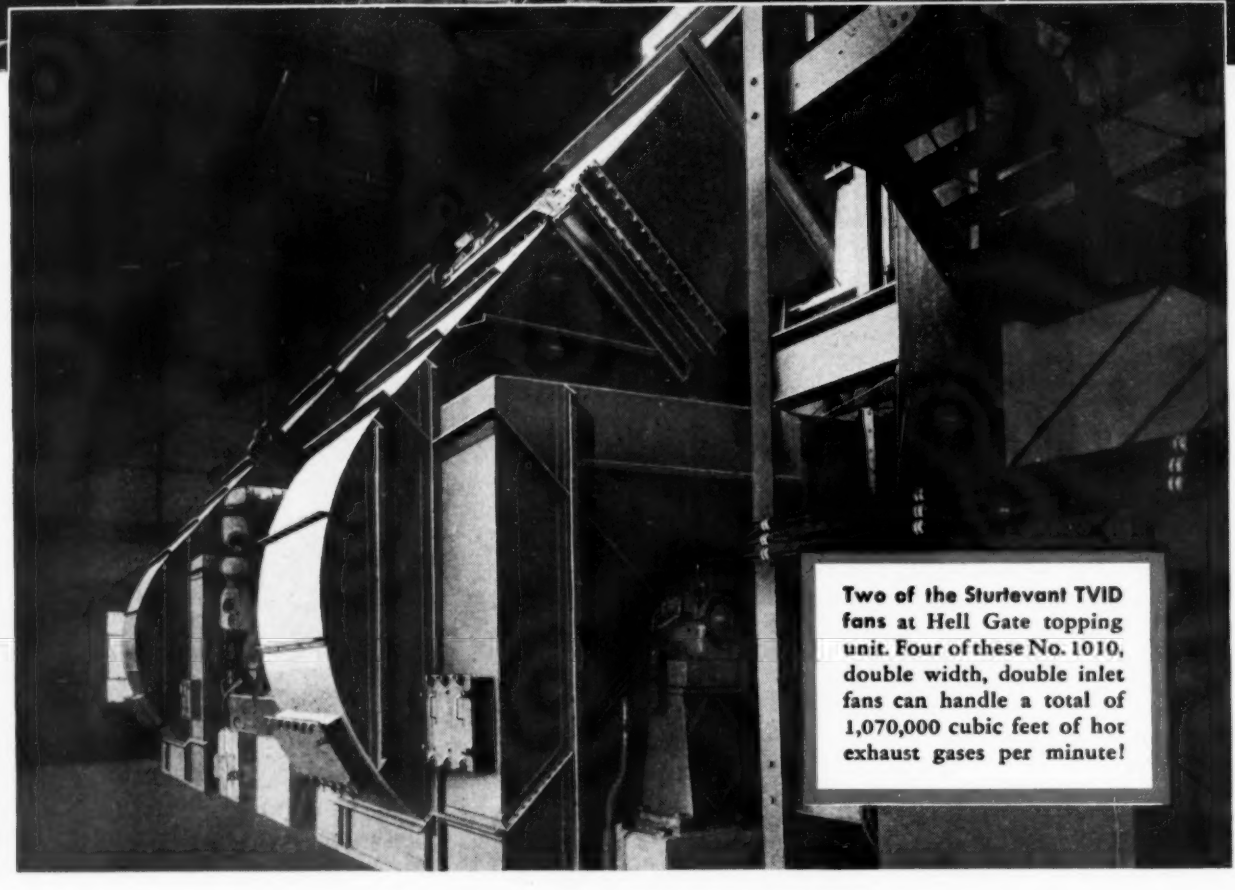
750—296

TRI/CLAD
REG. U.S. PAT. OFF.

**MOTORS**

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

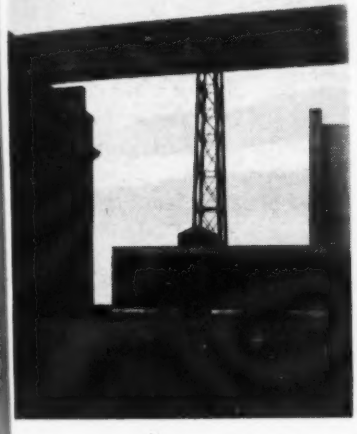
# HELL GATE TOPPING UNIT



**Two of the Sturtevant TVID fans** at Hell Gate topping unit. Four of these No. 1010, double width, double inlet fans can handle a total of 1,070,000 cubic feet of hot exhaust gases per minute!

# NOW GETS A MILLION CFM WITH 4 STURTEVANT FANS!

## They handle the exhaust gases from two 900,000 lb-per-hr boilers at Consolidated Edison station

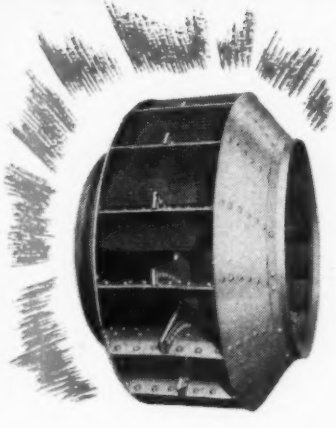


THE Hell Gate topping unit—part of Consolidated Edison's program to provide more power for New York City—brings the station's total output to 630,000 kw. The 65,000 kw topping turbine is supplied by two high-pressure boilers—each capable of delivering 900,000 lb of steam per hour, at 950 psi, 950F.

This job calls for plenty of induced draft—more than a million cubic feet per minute! And it calls for tops in dependability and performance too, for these boilers supply approximately 215,000 kw of high-pressure and low-pressure generating capacity. Sturtevant fans were the answer—two huge turbine-driven TVID units per boiler—each fan rated at 267,500 cfm, 16" static pressure, 375F. To assure maximum service continuity, these fans are equipped with Sturtevant's long-life erosion-resistant wheel.

The Consolidated Edison Company of New York has had lots of experience with Sturtevant fans. In three stations alone—Hell Gate, Hudson Avenue, and East River—45 TVID fans, each with E-R wheel, help supply more than half of New York City's power.

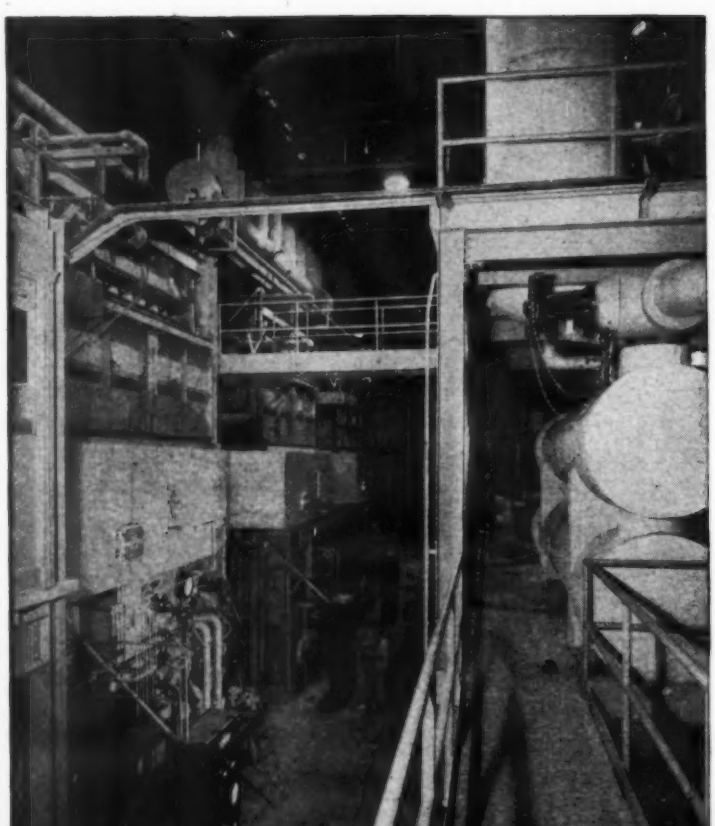
In power plants from coast to coast—from the largest central stations to small industrial plants—Sturtevant mechanical draft fans have established an outstanding record for performance, operating efficiency and low up-keep costs. Whatever your needs—induced draft fans, forced draft fans, primary air fans, fly ash collectors—Sturtevant, now a division of Westinghouse, can supply *all* of the equipment for the job, including the finest in steam or electric drives. For information, write to: Westinghouse Electric Corporation, *Sturtevant Division*, Hyde Park, Boston 36, Mass.



**WHY STURTEVANT'S E-R WHEEL LASTS 2 TO 4 TIMES LONGER**

Cutout centerplate makes fly ash attack itself—not the wheel! Renewable blade liners give extra wear—easily and quickly replaced.

Westinghouse
Sturtevant
DIVISION

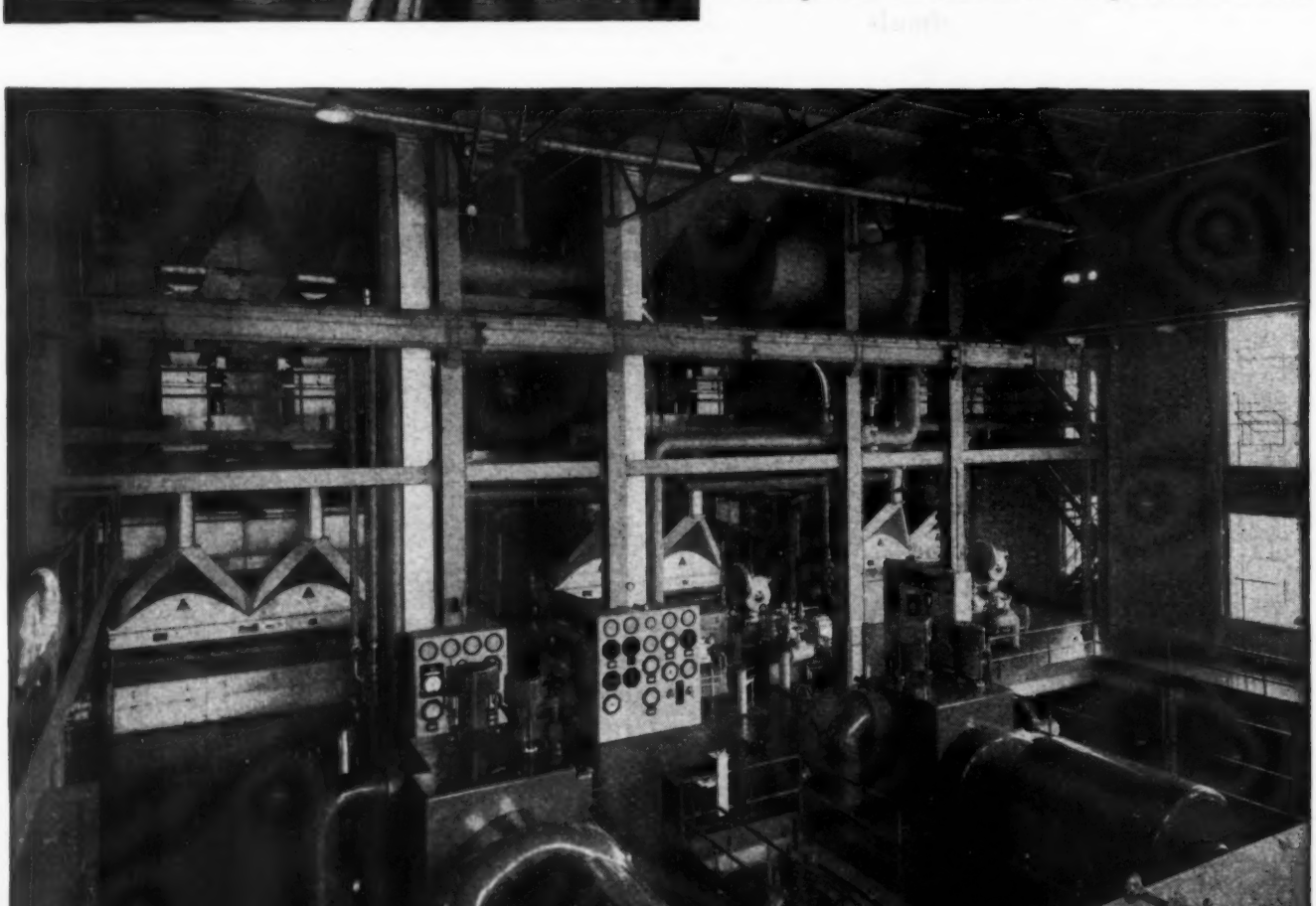


# IT TAKES

*Left:*
**Interior view of a new 400,000 lb. steam generating plant suppling steam for a modern industrial plant. Steam is generated in three gas fired boilers which are operated by a Republic automatic combustion control system.**

●

*Below:*
**A Republic combustion control system operates the three boilers in this new power plant which supplies all the steam and power for a large university. During the first year of operation this new plant provided heat for 13.0 percent more building space, generated 114.3 percent more electric power but consumed 9.86 percent less fuel.**



# MORE THAN A GOOD BOILER TO CUT STEAM COSTS!

**Low Steam Cost Is Not The Result Of Efficient Boiler Design Alone! It Is Determined By The Degree With Which Your Method Of Boiler Control Takes Full Advantage Of Those Economies Which Have Been "Built In" The Boiler And Its Auxiliaries.**

To realize all the financial and operating advantages of modern boilers, they must be closely controlled. They have comparatively small water storage spaces and high combustion rates, hence under some conditions may be very sensitive to load fluctuations. In operating them, therefore, a number of repetitive adjustments must be made frequently and practically simultaneously on several units of auxiliary equipment in order to maintain highest boiler efficiency. The difficulty of making the required repetitive adjustments accurately and synchronously by hand at the individual auxiliaries is obvious.

What is needed, therefore, is a method for making and co-ordinating these adjustments automatically from a centralized control point, at the same time permitting the operator to assume manual control at this point whenever necessary or desirable.

The REPUBLIC combustion control is a unified system controlling simultaneously, in measured quantities and in fixed (adjustable) proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

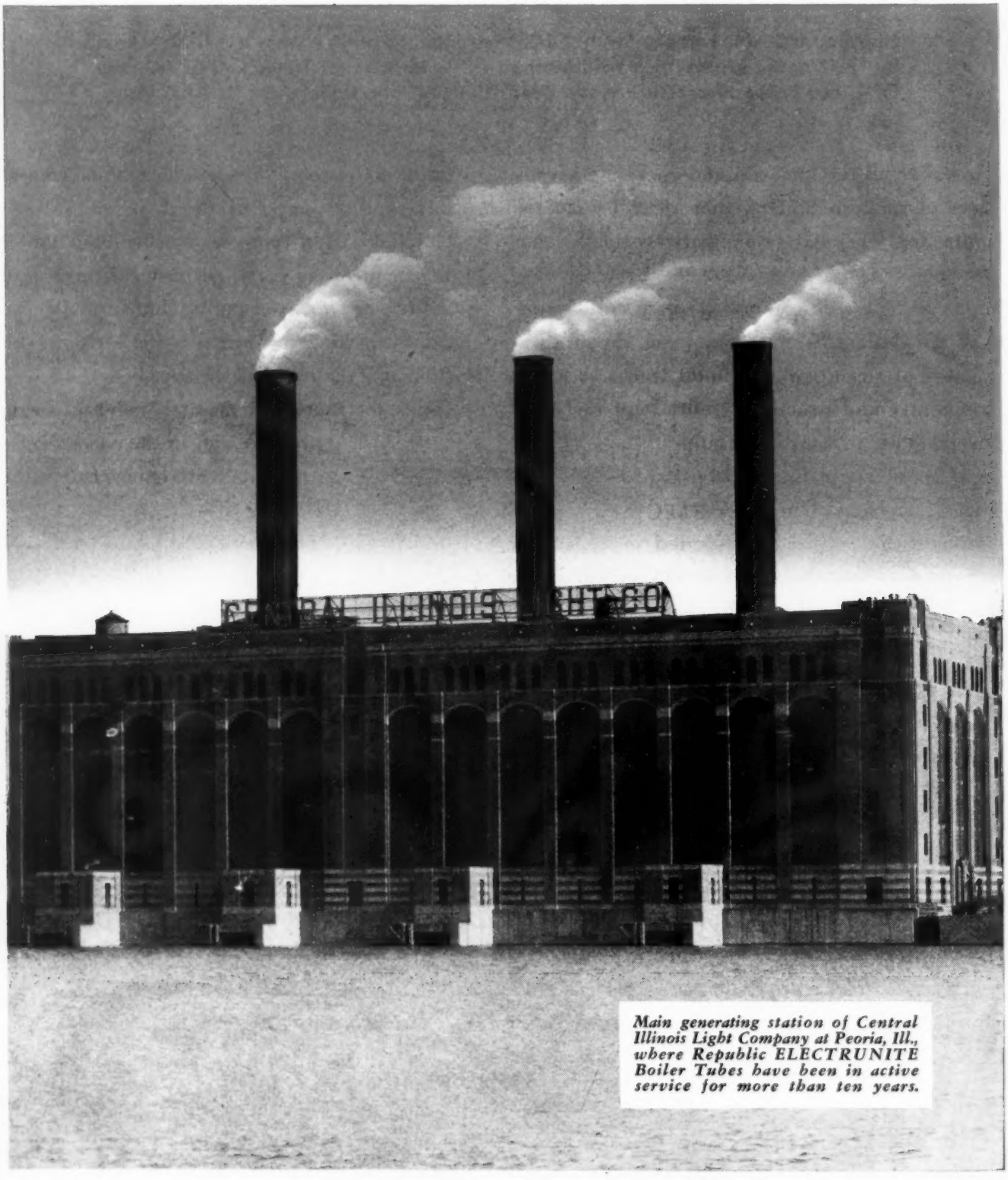
REPUBLIC combustion control systems are designed and built for all sizes of boilers—all types of fuel firing equipment—all load conditions. They fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of every-day operating requirements.

*This 94 page data book on automatic combustion control is filled with usable information generally difficult to locate. If you are interested in the advantages of automatic combustion control, write for Data Book No. S-21.*

## REPUBLIC FLOW METERS CO.

**2222 DIVERSEY PKWY. CHICAGO 47, ILL.**

# In PEORIA



*Main generating station of Central Illinois Light Company at Peoria, Ill., where Republic ELECTRUNITE Boiler Tubes have been in active service for more than ten years.*

# *it's* ELECTRUNITE

## . . . IN 1936, 1939 AND AGAIN IN 1947 ELECTRUNITE BOILER TUBES INCLUDED IN NEW STEAM GENERATING EQUIPMENT

Late this year, two new steam generating units will be installed at the Central Illinois Light Company in Peoria, Illinois. In these, as in previous installations in November 1936 and July 1939, Republic ELECTRUNITE Tubes will be used exclusively in the boilers and water walls.

As shown in the diagram at the right, each generating unit is 113 feet in overall height—designed to provide 300,000 lbs. of steam per hour, operating at 925 lbs. pressure and 900°F. Steam Temperature.

Here is one more in the long list of central station installations in which ELECTRUNITE Boiler Tubes again are included as original equipment—one more reason why it will pay you to investigate the many dollar-saving advantages of these *modern* tubes made by Republic's exclusive ELECTRUNITE Process.

For complete information about ELECTRUNITE Boiler Tubes—names of users, technical data or informative literature—write today to:

**REPUBLIC STEEL CORPORATION**
**STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO**
Export Department: Chrysler Building, New York 17, N.Y.

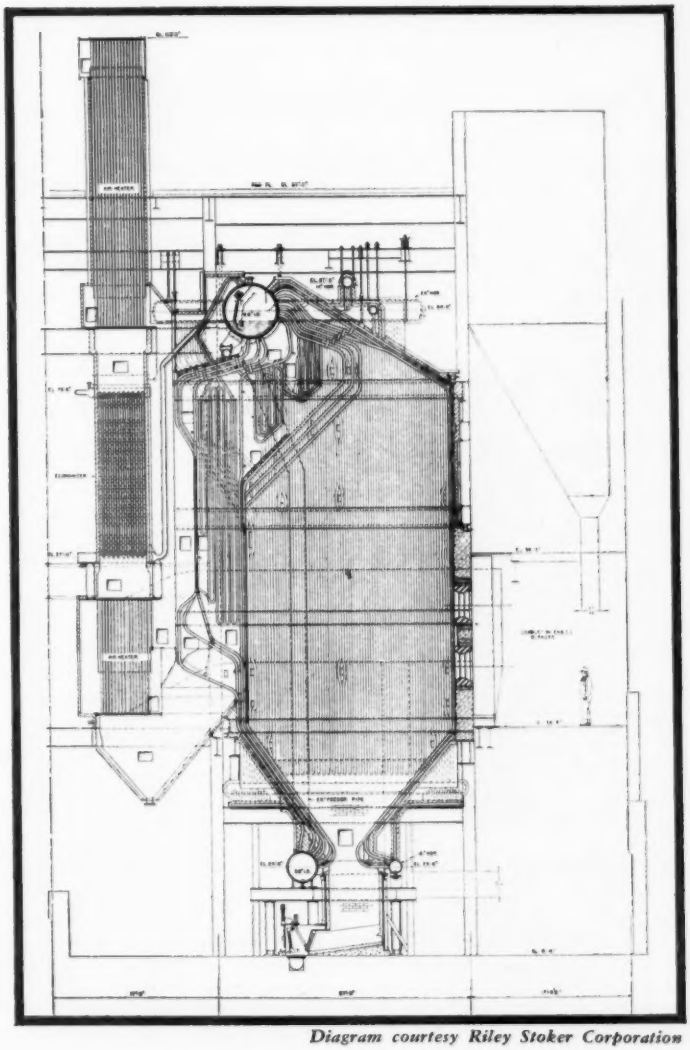


*Diagram courtesy Riley Stoker Corporation*

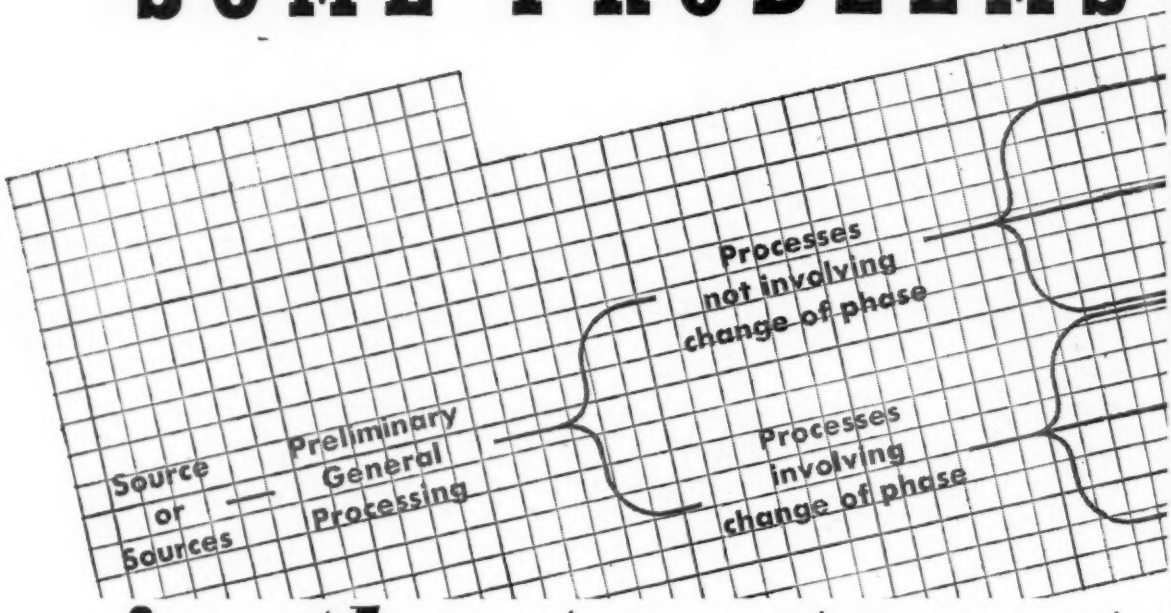
*Republic* REPUBLIC STEEL

ELECTRUNITE

Reg. U. S. Pat. Off.

BOILER, CONDENSER AND HEAT EXCHANGER TUBES

# SOME PROBLEMS


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

# ....in the treatment

Treatment of water for use in industrial processes involves as many problems as there are processes—multiplied by the number of water conditions that may be encountered.

### *Affects Plant Location*

To some extent problems of water treatment must be considered before a plant is built. In textile processing for example, virtually every process requires water which is low in hardness, hence such plants are located, when possible, in soft water areas. Treatment is still required, but softening is less difficult and less expensive.

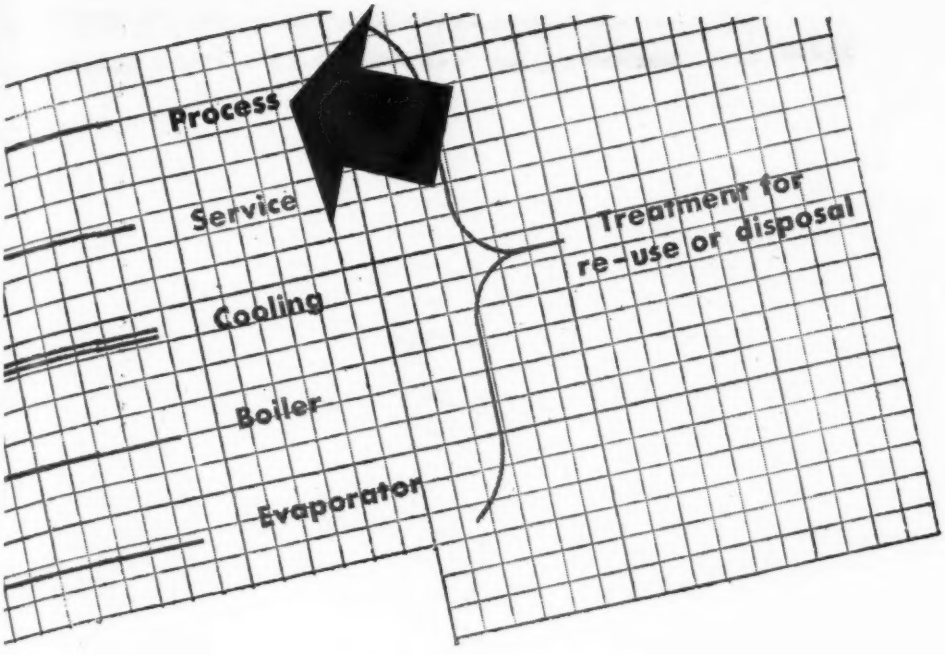
Paper manufacturing plants, on the other hand, can, in many processes, use water which is fairly hard, hence this is not an important factor in determining their location or the water sources which they may utilize.

The presence of dissolved iron or manganese in the water, however, is detrimental in both industries. Stains, duller shades in dyed goods, and reduced efficiency of bleaching are among their effects. Plants try to obtain water supplies which are free of these substances, but even waters which are free of iron may be corrosive, and iron may be picked up from the pipes through which the water flows.

### *Microbiological Growths*

It is now known, too, that certain bacteria produce gelatinous deposits of iron oxide. Others cause unpleasant odors. Still other microbiological growths are responsible for slime, which is undesirable in almost every process and which also clogs pipes and filter equipment. The presence of these organisms must

HAGAN
HALL
BUROMIN
CALGON




# of process waters

be determined, and treatment to destroy them must be provided.

If organic or coloring materials are present, they should be removed. Odors are usually undesirable, and should be eliminated.

### *Plant-wide Study Required*

These are only a few of the problems that may arise. In a laboratory the solution of many of them is relatively simple; in industry the situation is quite different. The very volume of water to be treated adds to the difficulty, as does the rate at which it must be treated. Cost becomes a major factor, and cost includes not only the materials of treatment but also the equipment and labor which may be required.

Solutions must be worked out on a plant-wide basis. Related problems must be coordinated. Dozens of factors must be considered from the water source to the final disposal of waste. And always there is the challenge—"Can this be done more economically and effectively in some other way?"

Hall Laboratories is equipped to consider all of the water problems of an industrial plant *as a whole.*

### *Procedures for Specific Problems*

It is prepared to recommend procedures which, taking all factors into account, represent the most efficient and economic solution in your specific case. Correspondence concerning any problem of industrial water treatment is invited.

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

## HALL LABORATORIES, INC.

*(A Subsidiary of Hagan Corporation)*

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

# One of a Kind

Powerful *Texrope* drive specially engineered for a large mill. This main driver sheave is 7 ft in diameter, has 30 grooves, transmits 1400 hp!

# ...or One of A THOUSAND!

## EVERY TEXROPE DRIVE IS ENGINEERED FOR ITS JOB

YOU GET sound recommendations from Allis-Chalmers — recommendations backed by the greatest V-belt engineering talent and experience in the business.

Allis-Chalmers originated the Multiple V-belt drive 22 years ago. Since then, *Texrope* engineers have designed many thousands of drives, ranging from fractional horsepower units for manufacturers of small compressors, pumps or washing machines—to the largest V-belt drives ever installed. They've served: Textile, Mining, Metal working, Petroleum, Chemical . . . in fact, *every* major industry.

Take advantage of this vast research and experience. Bring your V-belt problems to headquarters — for the best in engineering talent — for the most complete line of V-belt equipment made.

Service is as close as your nearest Allis-Chalmers dealer or office. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2239

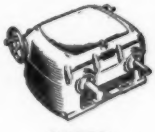
**Refer to Sweet's Catalog**

## TEXROPE .. Greatest Name in V-Belt Drives

**"Super 7" V-BELTS**
Five Types — Sizes to suit every power transmission job.

**Texsteel, Texdrive, "Magic-Grip"**
— sheaves in a full range of sizes, grooves.

**"Vari-Pitch" SHEAVES**
Exact variations in speed, stationary or motion control.



**SPEED CHANGERS**
Speed variations up to 375% at the turn of a crank.

**ENGINEERING**
Finest V-Belt engineering talent in the world—at your call.

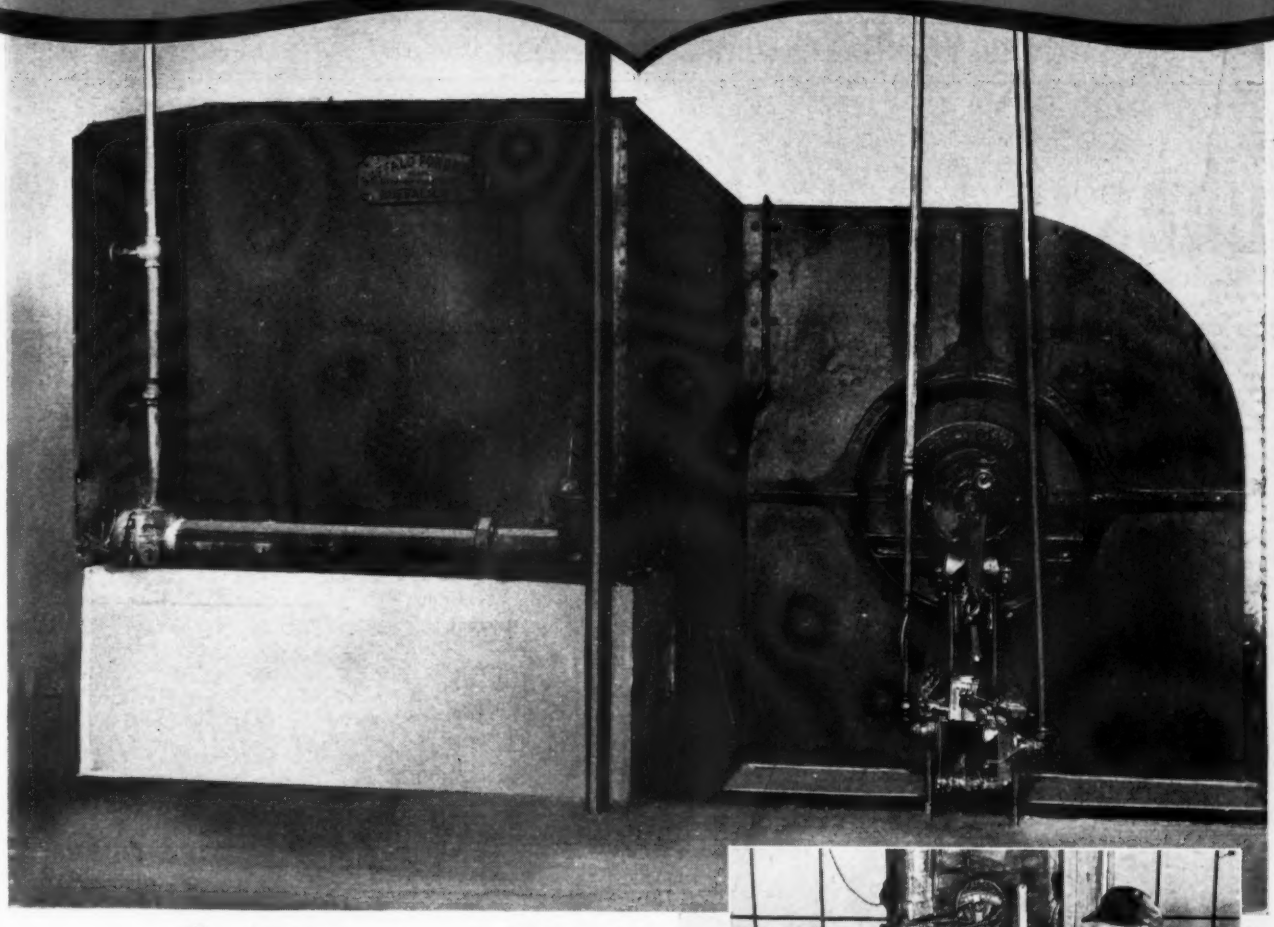
TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

# ALLIS-CHALMERS

**One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products**

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

# 47 YEARS *on the Job!*



## "Buffalo" BIG or LITTLE FANS LAST

When you invest in a fan, one of the big questions to ask is: *How many years will this investment keep serving?*

The "Buffalo" fan shown above was installed in 1900 . . . and it's still paying "air dividends".

And the many other reports we receive from "Buffalo" fan owners indicate that "Buffalo" installations are practically permanent fixtures in the countless plants, institutions and stores where they serve. Repairs and replacements have been few and far between . . . upkeep and power costs low . . . delivery, high!

Before you invest in a fan, it will pay you to look into the "Buffalo" line. Simply write us stating the air job you have in mind.

**BUFFALO FORGE COMPANY**

488 BROADWAY BUFFALO, N. Y.

*Canadian Blower & Forge Co., Ltd., Kitchener, Ont.*

**36 Years on the Job!**

"I have been using one of your model 2-E electric Forge blowers for the past 36 years and just this week it has given out, and, from investigation, seems the commutator has failed.

"Have been wondering if there is a possibility of securing another commutator.

"I am a blacksmith by trade, and from the long number of years I have used my present Buffalo Forge Blower, you can see how wonderfully it has performed."

*Very truly yours,*

**O. P. WARRENDER, 2103 Central Ave., Anderson, Ind.**

"Buffalo" "FIRST FOR FANS"

# FANS for INDUSTRY

# Scovill Tube News

Vol. 5 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 2

# Tubes of Scovill Cupro-Nickel, 30% Prove Best for Hydraulic Dredge

Dredge service, at its best, is hard on Condenser Tubes. This is readily understandable when you consider that in the performance of its natural function, a dredge constantly disturbs the bottom of the body of water on which it floats. This water with its heavy load of suspended solids constitutes the only available supply of coolant for the condenser. Hence, abrasion poses a serious problem in this condenser tube application.

Moreover, water temperatures range from approximately 32°F. in northern waters in winter to a maximum of 95°F. in southern waters in summer. Obviously, more water must be circulated in the warmer climate and season. This necessitates higher velocities of the silt-filled coolant through the tubes with consequent severe impingement attack and abrasive action.

For many years, the Hydraulic Dredge "Pittsburgh", owned by Atlantic, Gulf and Pacific Co., was satisfactorily served by Scovill Admiralty Metal tubes. Their service life varied, of course, according to the location of the dredging assignments.

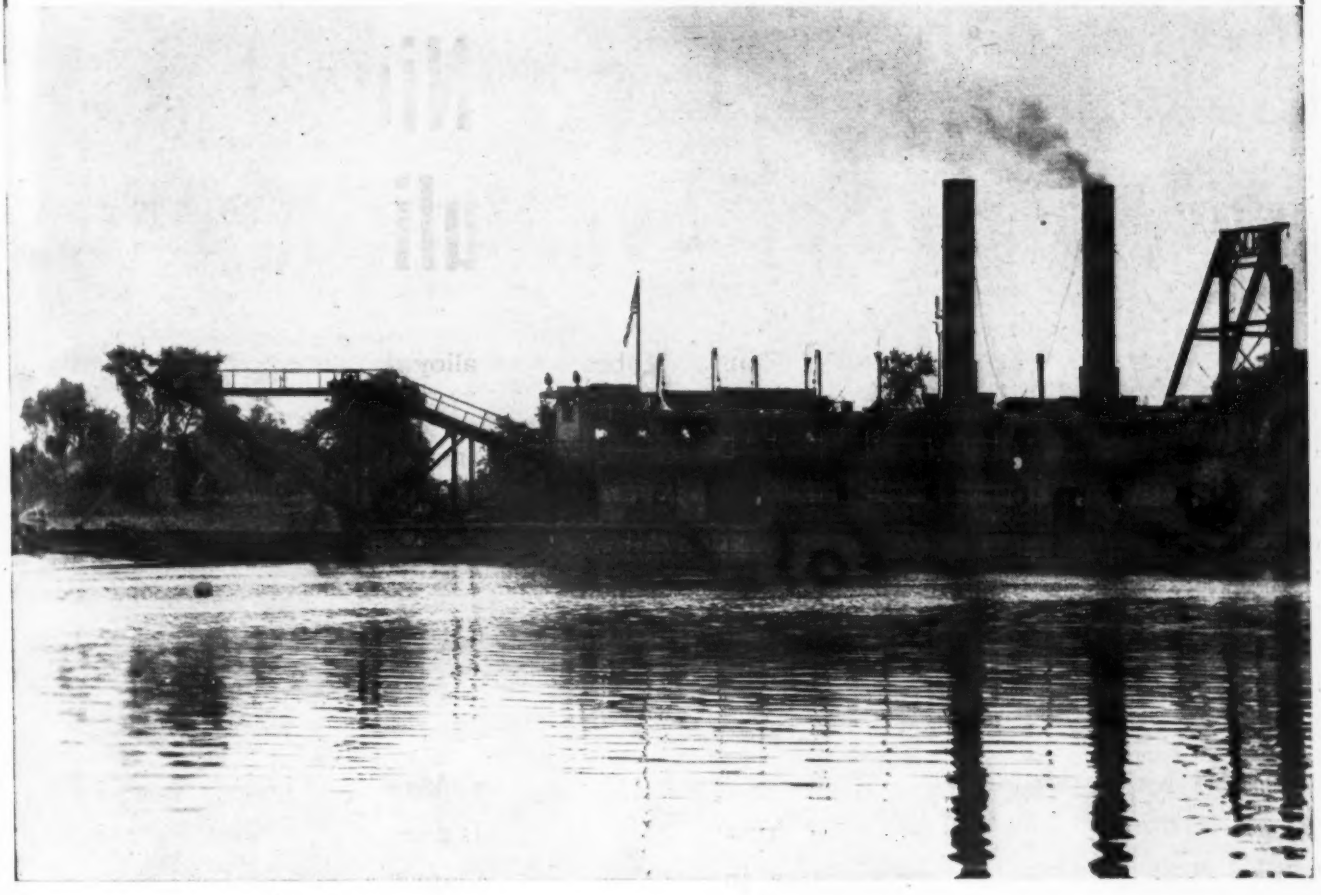
However, when Cupro-Nickel, 30% was developed, it was soon discovered that Scovill tubes of this alloy, by reason of their superior resistance to both corrosion and abrasion, gave more economical service on this installation than Admiralty Metal. In other words, they *last longer per dollar's worth of material* — the most accurate gauge of a tube alloy's value.

### Three Scovill Services

*Service in Manuals*, of which "Scovill Tube News" is a sample, consists of literature providing the latest, most authentic information* on condenser and heat exchanger tubes, which has its source in the broad experience of our engineers and the findings of our laboratories. *Service in Men* offers specialized consultation on individual tube application problems and suggestions regarding alloy selection and tube installation practice. *Service in Metals* includes the development and production of a wide range of tube alloys under laboratory control, which verifies that Scovill alloys conform to specifications.

*A "Condenser Tube Booklet" is available. Scovill Manufacturing Company, 13 Mill St., Waterbury 91, Connecticut. *Export Dept.*, 405 Lexington Ave., New York 17, N. Y.

# HYDRAULIC DREDGE PITTSBURGH
## Owned by Atlantic, Gulf and Pacific Co.



Main Drive.....Geared Steam Turbine
Cutting and Swinging....by Electric Motors
Discharge Pipe.....27″ diameter
Steam Condenser.....Elliott 4,000 sq. ft.

SCOVILL

# SCOVILL CONDENSER TUBES

*ONE PRODUCT... THREE SERVICES*

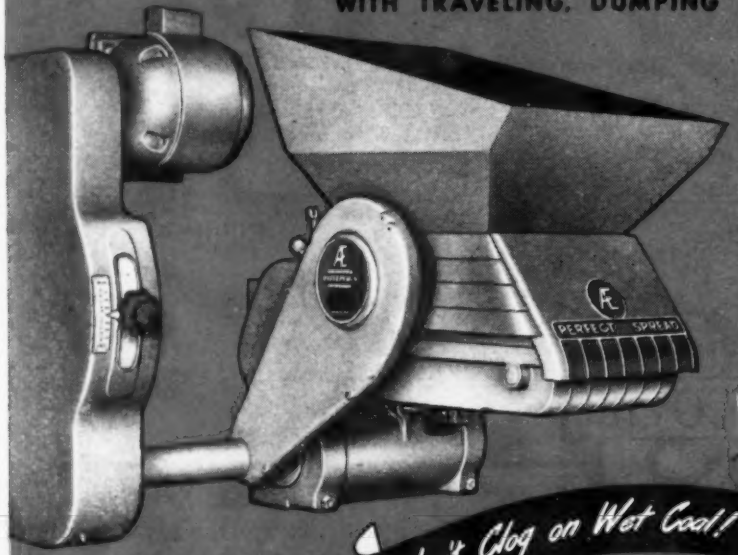
Service in Manuals... Service in Metals... Service in Men

A coal supply that is wet, dry, or partially frozen will no longer be a problem with an Æ Perfect Spread Stoker in your boiler room. You will be able to feed it a wide variety of fuels and watch it operate quietly and efficiently—without clogging. Whether you're now hand-firing your boilers or want to replace inefficient boilers, you'll appreciate the exclusive Æ features that assure you automatic steam generation with consistently thorough combustion at low operating cost.

Its efficient performance has saved thousands of dollars for scores of owners in many types of businesses. Reduce *your* boiler room costs with the Æ Perfect Spread Stoker. Investigate now. Write for descriptive booklet today!

# PERFECT SPREAD STOKER

WITH TRAVELING, DUMPING OR STATIONARY GRATES



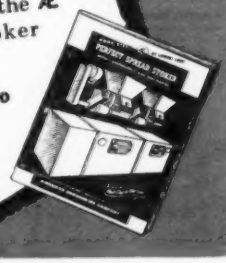

Won't Clog on Wet Coal!

## ALWAYS PLENTY OF STEAM —AUTOMATICALLY

The Æ Perfect Spread Stoker responds immediately through automatic controls to sudden and extreme changes in the steam load. It can run from a banked fire to more than twice the normal rating in a few minutes. Gets steam up fast and keeps it there!

**FREE**—Get this valuable descriptive booklet on the Æ Perfect Spread Stoker today!

Address inquiries to 2400 Aramingo Ave., Philadelphia 25, Pa.

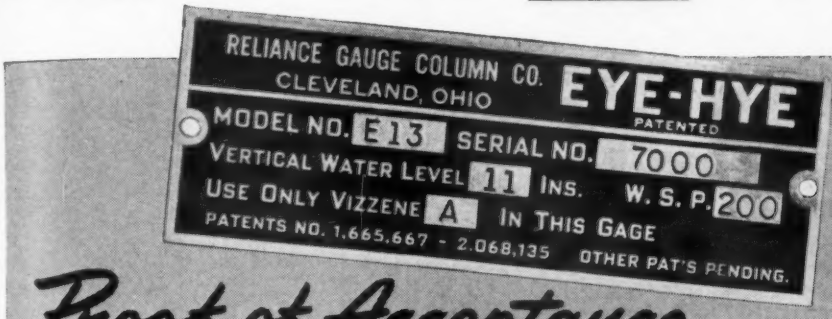


Other Æ Products: Æ-TAYLOR STOKERS, LO-HED HOISTS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

**AMERICAN ENGINEERING COMPANY**

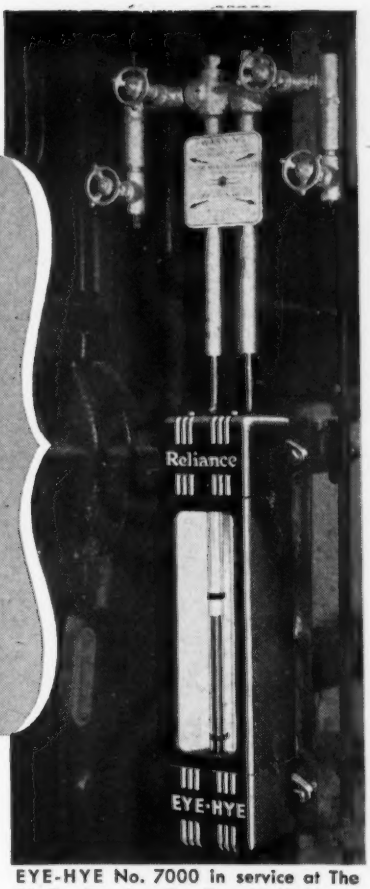
2400 ARAMINGO AVENUE • PHILADELPHIA 25, PA.

# Now it's well over 7000




## *Proof of Acceptance*

## is this milestone in the production progress of Reliance EYE-HYE




EYE-HYE No. 7000 in service at The Pfieffer Brewing Co., Detroit, Michigan.

## The original all-hydrostatic remote-reading water level indicator

One way you can be sure you are right in ordering EYE-HYE Remote Reading Gage equipment for your boilers is to consider its long record of satisfactory performance in all types of power plants—stationary and marine—ten years of constant acceptance growth—over 7000 placed in service. We celebrate the installation of EYE-HYE No. 7000 merely because it represents a milestone—a round figure. Actually, hundreds more have been shipped and are on order. The present modern design models are shown at the left.

### *The reasons for EYE-HYE's wide acceptance are many:*

**Simplicity:** Based on the scientific U-tube principle—all-hydrostatic, with no complicated mechanisms to adjust or get out of order.

**Accuracy:** Full range accuracy assured by Reliance Unitemp—constant head reservoir which compensates for temperature variation.

**Clear Indication:** Reads like water gages you've always known, only *better*. Water indication in illuminated green liquid, *more visible* than water.

**Flexibility of Placement:** Can be installed any reasonable distance from the drum, either *below* or *above* it.

**Easy to Install:** Two lines of tubing can follow most convenient route between drum and EYE-HYE location.

**Models for all Pressures:** From lowest pressures (even at vacuum) to as high as 2500 lbs. Valuable for all types of auxiliary boilers and tanks.

**Convenient Mounting:** Can be placed on instrument panel board or any convenient wall or support.

• • • • • • • • • • •

***For outstanding safety and accuracy in water level reading... depend on EYE-HYE***

BOILER SAFETY DEVICES since 1884

# Reliance

THE RELIANCE GAUGE COLUMN CO. · 5902 CARNEGIE AVENUE · CLEVELAND 3, OHIO

# These Inconel properties can help you solve many HIGH TEMPERATURE problems

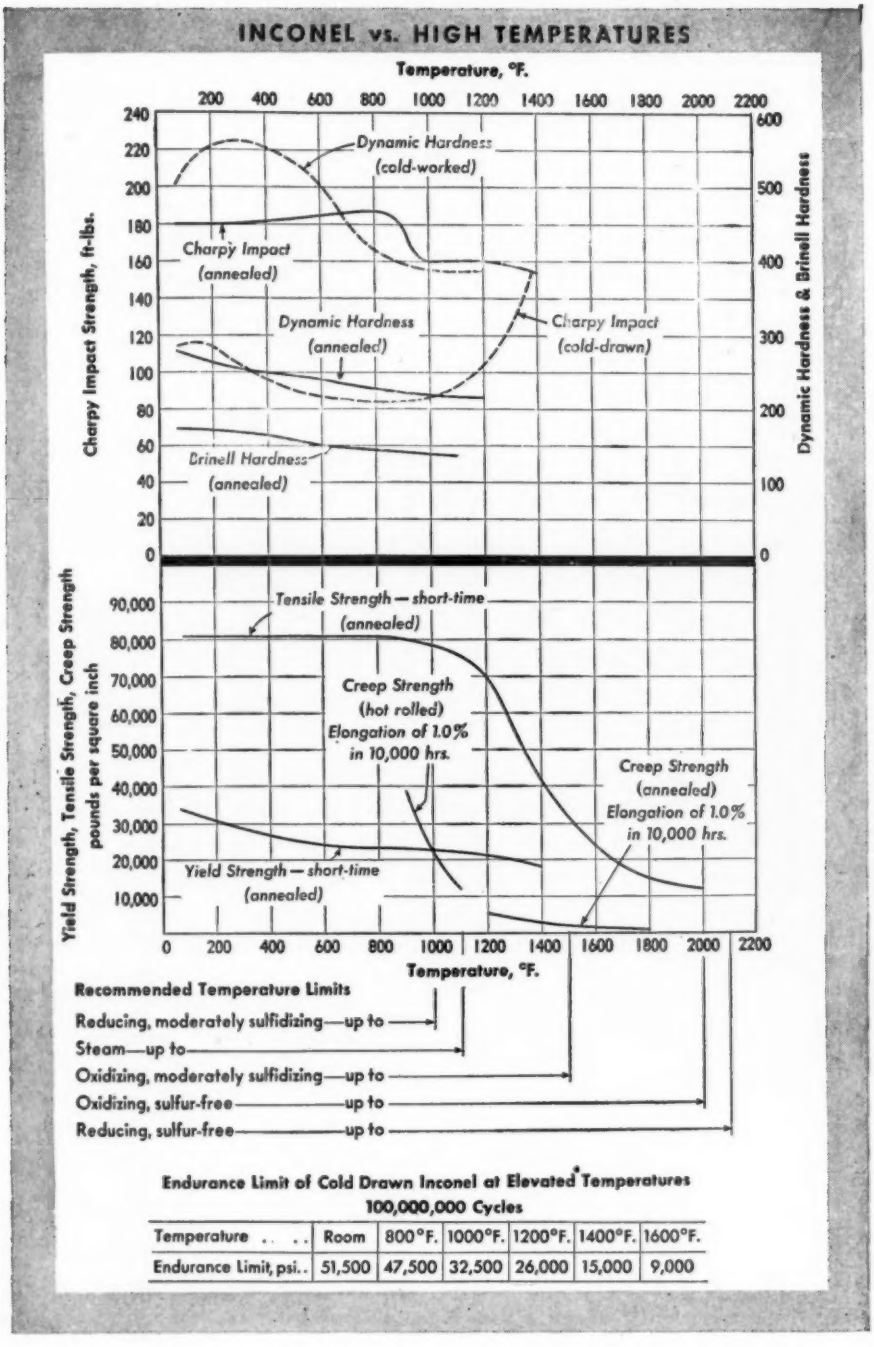
To stand high temperatures, a metal must have:

1. **Good resistance to oxidation**
2. **Good mechanical properties at high temperatures**

Alone, neither one of these properties amounts to much. If cross-sections are rapidly reduced by the scaling away of oxidized layers, high strength is of little value. On the other hand, if the material becomes too soft and weak at operating temperatures to support the designed load, then freedom from scaling goes for naught.

The only way to get the long life you're after, is to specify a metal possessing *both* properties.

In Inconel* you have both!


INCONEL vs. HIGH TEMPERATURES
Temperature, °F.
200 400 600 800 1000 1200 1400 1600 1800 2000 2200
Charpy Impact Strength, ft-lbs.
Dynamic Hardness & Brinell Hardness
Dynamic Hardness (cold-worked)
Charpy Impact (annealed)
Dynamic Hardness (annealed)
Charpy Impact (cold-drawn)
Brinell Hardness (annealed)
Yield Strength, Tensile Strength, Creep Strength pounds per square inch
Tensile Strength — short-time (annealed)
Creep Strength (hot rolled) Elongation of 1.0% in 10,000 hrs.
Creep Strength (annealed) Elongation of 1.0% in 10,000 hrs.
Yield Strength — short-time (annealed)
Temperature, °F.
Recommended Temperature Limits
Reducing, moderately sulfidizing—up to
Steam—up to
Oxidizing, moderately sulfidizing—up to
Oxidizing, sulfur-free—up to
Reducing, sulfur-free—up to

**Endurance Limit of Cold Drawn Inconel at Elevated Temperatures**
**100,000,000 Cycles**

| Temperature . . . | Room | 800°F. | 1000°F. | 1200°F. | 1400°F. | 1600°F. |
|---|---|---|---|---|---|---|
| Endurance Limit, psi. . | 51,500 | 47,500 | 32,500 | 26,000 | 15,000 | 9,000 |

An 80 per cent nickel—14 per cent chromium alloy, Inconel ideally combines the thermal durability of these two elements.

Inconel resists scaling and intercrystalline attack; shows high tensile strength, creep strength, impact strength, endurance limit and hardness at elevated temperatures. The charts above show why Inconel has set so many service records.

***Remember Inconel*** wherever you have to fight Heat! Among power plant uses are packing, springs, special gaskets, refractory bolts, ash screens, thermocouple protection tubes, valve parts, instruments and the like.

*For more information on the mechanical properties of metals, write for:*
"THE TECHNICAL EDITOR SPEAKS."

**NICKEL** (INCO TRADE MARK) **ALLOYS**

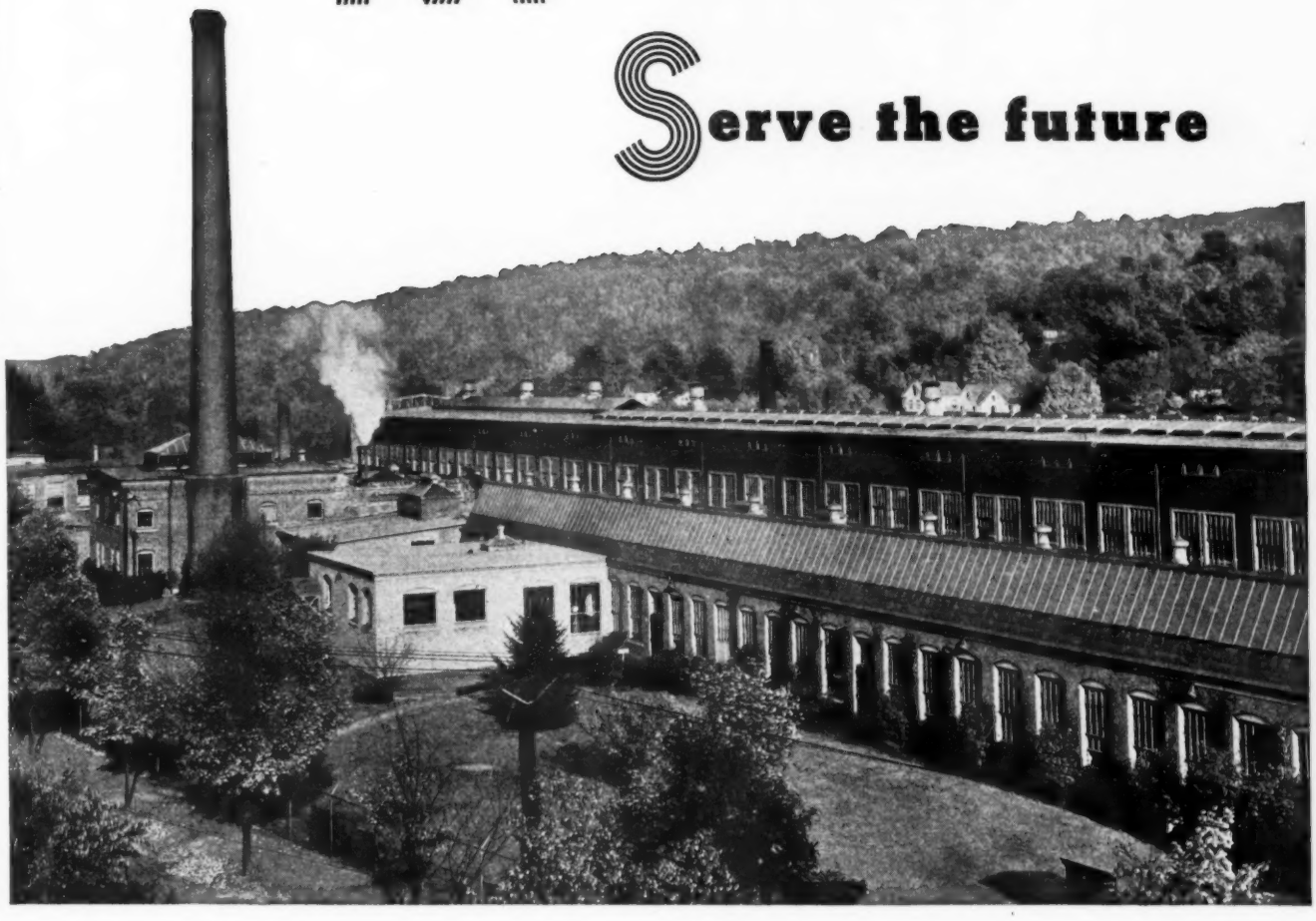
**THE INTERNATIONAL NICKEL COMPANY, INC.,** *67 WALL STREET, NEW YORK 5, N. Y.*

MONEL* · "K" MONEL* · "R" MONEL* · "KR" MONEL* · "S" MONEL* · INCONEL* · NICKEL · "L" NICKEL* · "Z" NICKEL*

*Reg. U. S. Pat. Off.

# Making the past

# Serve the future



WITH an enviable record of achievement behind us, and mindful of important responsibilities of the present and future, Warren enters its fiftieth year in business. Tomorrow's pumps will be better than today's. . . and to this advance Warren will make important contributions, just as it has in the past. ★ The entire Warren organization has the background, the facilities and the determination to serve you. It will continue to do so faithfully and well.

**WARREN STEAM PUMP COMPANY, INC.**

**WARREN, MASSACHUSETTS**

Atlanta Boston Chicago Cleveland Denver Detroit Houston Manchester, Conn. Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis

P-11

**WARREN PUMPS**

Fig. 1430
Iron Body Gate

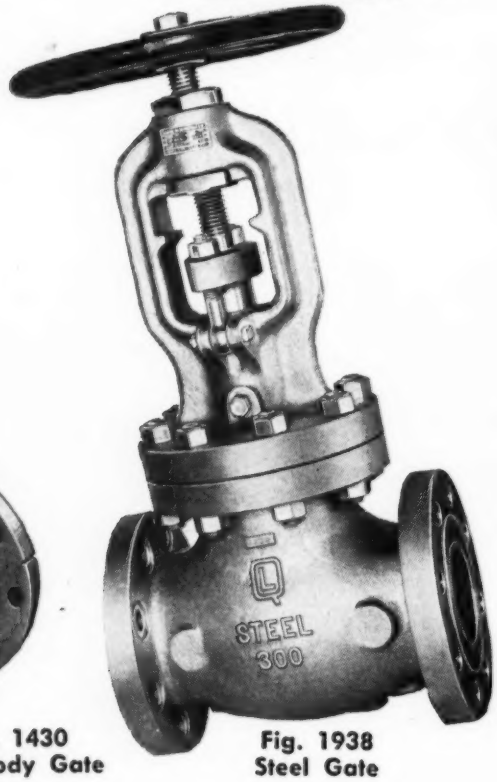



Fig. 1938
Steel Gate

Fig. 1640
"King-clip"
Gate

# LUNKENHEIMER

**BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.**

# *for* KEENER COMPETITION

## *A NEW PRODUCTION CHALLENGE!*

● The principal markets of today and tomorrow will go to the best-equipped, most efficient producers. Will your plant be among these leaders?

Modern equipment, the key to this new, highly competitive era, includes more than efficient machinery . . . it takes in every corner of your plant.

Consider valves, for example. Good valves are necessary for operating efficiency. LUNKENHEIMER VALVES meet every requirement, for dependable service. Proved through the years . . . in every industry . . . under the most exacting conditions, they deliver longer service at lower maintenance cost. Industrial users trust LUNKENHEIMER VALVES—know they combine carefully selected materials, advanced design and superior workmanship, backed by 85 years of valve manufacturing experience.

ESTABLISHED 1862

**THE LUNKENHEIMER CO.**

—"QUALITY"—

**CINCINNATI 14, OHIO. U. S. A.**

NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 7

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

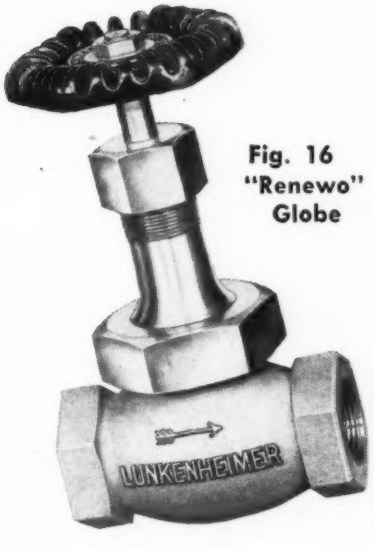



**Fig. 16**
**"Renewo"**
**Globe**

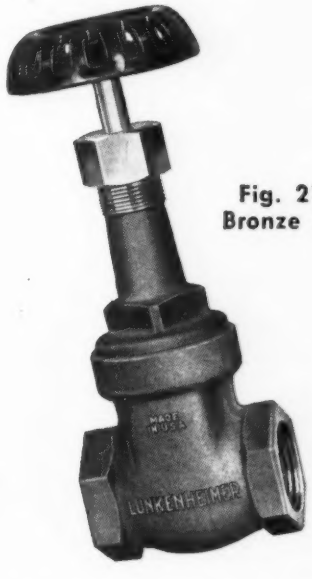



**Fig. 2125**
**Bronze Gate**

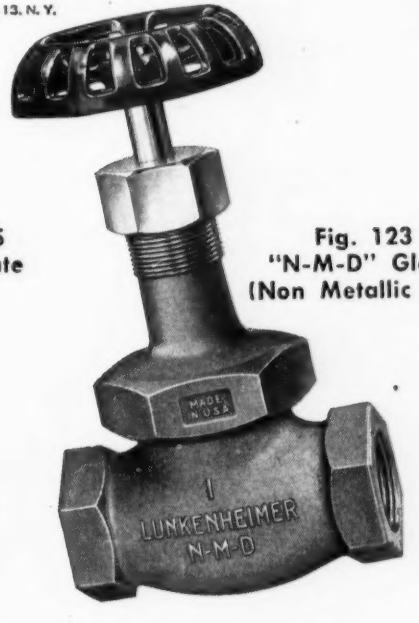



**Fig. 123**
**"N-M-D" Globe**
**(Non Metallic Disc)**

● And, backing up this high quality . . . insuring utmost satisfaction, is a nation-wide service organization. The next time you have a valve problem . . . installation, maintenance, repair or operation . . . call your Lunkenheimer Distributor. You'll find his service, like that of LUNKENHEIMER VALVES, truly dependable—always.

# VALVES

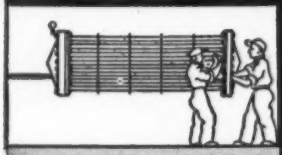
## *Serve Longer . . . at Lower Cost*

**BOILER MOUNTINGS, AIR CONTROL DEVICES LUBRICATING DEVICES, AIRCRAFT FITTINGS**

# New Conseco Condenser Tube Sheet

1. Automatically indicates leakage during operation
2. Permits quick location and correction of leaks
3. Prevents contamination of heat exchange mediums

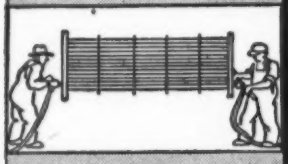
## Why test this way?



1—Install two test heads, gaskets and connections.
2—Secure with necessary bolts, nuts, washers.

3—Apply test pressure and watch for leakage.
4—If leaking guess which tube?

5—Remove test heads, connections, nuts, washers.



6—Reroll BOTH ends of ALL tubes.
7—Reinstall test heads, connections, bolts, nuts, and washers.
8—Reapply test pressure and pray that unit is tight.
9—If not tight, repeat previous operations until it is. Records show that a 6-hour retubing job took 24 hours more just to locate one leaking tube.

The New CONSECO DOUBLE TUBE SHEET relieves the operator of his worst troubles and worries resulting from leaks which develop, during operation, in the rolling between tube and tube sheet of any heat exchanger or steam condenser.

The New CONSECO design utilizes a DOUBLE TUBE SHEET (Patent Pending) incorporating a pressure chamber (Fig. 1). The chamber is filled at all times with the desired heat exchange medium at a pressure greater than that of the circulating pump or pressure on shell side. When and if a leak develops between the rolling of any tube and tube sheet, the medium in the pressure chamber (being under greater pressure than that of the circulating pump or the shell side pressure, whichever is greater) will flow into either the water box or shell side, depending on which side of the double tube sheet leak occurs, as shown in Figures 2 and 3.

The MEDIUM SELECTED FOR THE PRESSURE CHAMBER IS DETERMINED BY VALUE OF PRODUCT ON EITHER SHELL OR TUBE SIDE OF THE HEAT EXCHANGER, THUS AVOIDING CONTAMINATION OF THE MORE COSTLY MEDIUM. AND the unit can safely continue in operation until convenient to shut down and repair leaking tube.

### NO TEST HEADS ARE REQUIRED

TESTING OF UNITS INCORPORATING CONSECO'S NEW DOUBLE TUBE SHEET DESIGN IS *EASY, QUICK, POSITIVE* because leaks are visible. All guesswork and long, tedious, cumbersome methods of testing are eliminated, as illustrated.

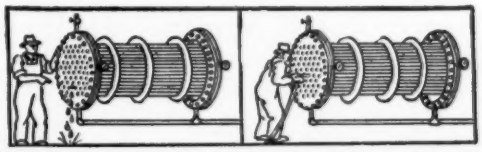
The New CONSECO DOUBLE TUBE SHEET as applied to STEAM CONDENSERS is illustrated in Fig. 4.

Water, distilled or from a fresh water supply, is introduced at the bottom of the pressure chamber of the double tube sheets at inlet and return ends of the condenser. Standpipes leading from the top of each double tube sheet are connected to a common standpipe, which, in turn, connects to a fresh water tank. The height of the fresh water tank is determined by the head equivalent to the circulating pump pressure (usually 5' greater to maintain positive pressure in chamber of tube sheets). The fresh water tank is fitted with a float-actuated alarm to indicate leaks, when they occur, and warn the operator.

With The NEW CONSECO DOUBLE TUBE SHEET contamination of condensate with circulating water is absolutely IMPOSSIBLE. The unit can operate SAFELY until convenient to shut down. FILLING CONDENSER and turbine with water to obtain desired test pressure is eliminated. The leaks are spotted quickly (as they are visible) and corrected.

The CONSECO DOUBLE TUBE SHEET pertains to leaks developing between tube and tube sheets. Our DETECTALEAK TESTER finds pinhole leaks in tubes quickly, simply and positively. AGAIN—No filling of condenser with water is necessary.

**With Conseco Double Tube Sheet testing is simple, quick, positive**



1-Apply test pressure to double tube sheets. SEE which tube, if any, leaks.

2-Reroll leaking tube until tight, and you are SURE that unit is tight.

SERVICE

**CONDENSER SERVICE & ENGINEERING CO., INC.**

95 RIVER ST., HOBOKEN, N. J. Phone HOboken 3-4425 After 6 P.M. or Sunddys - HOboken 3-4428

# Quick to test · · · Easy to keep tight

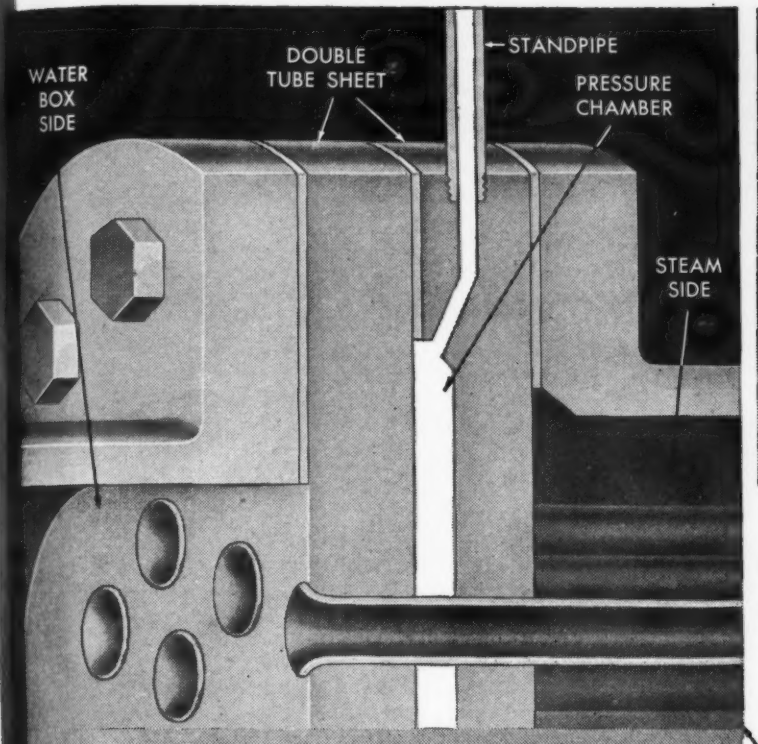



Fig. 1—Section through Conseco Double Tube Sheet, showing pressure chamber filled with fresh water under pressure higher than that of circulating or cooling water.

## How the double tube sheet works

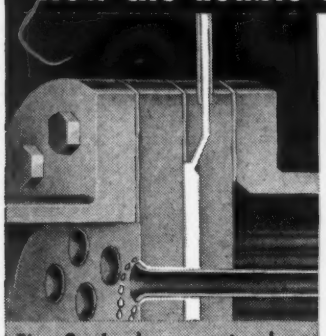


Fig. 2—Leak on water box side forces fresh water to leak into circulating water, never in reverse direction.

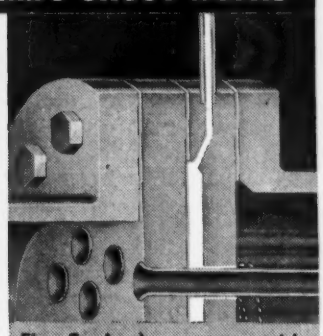
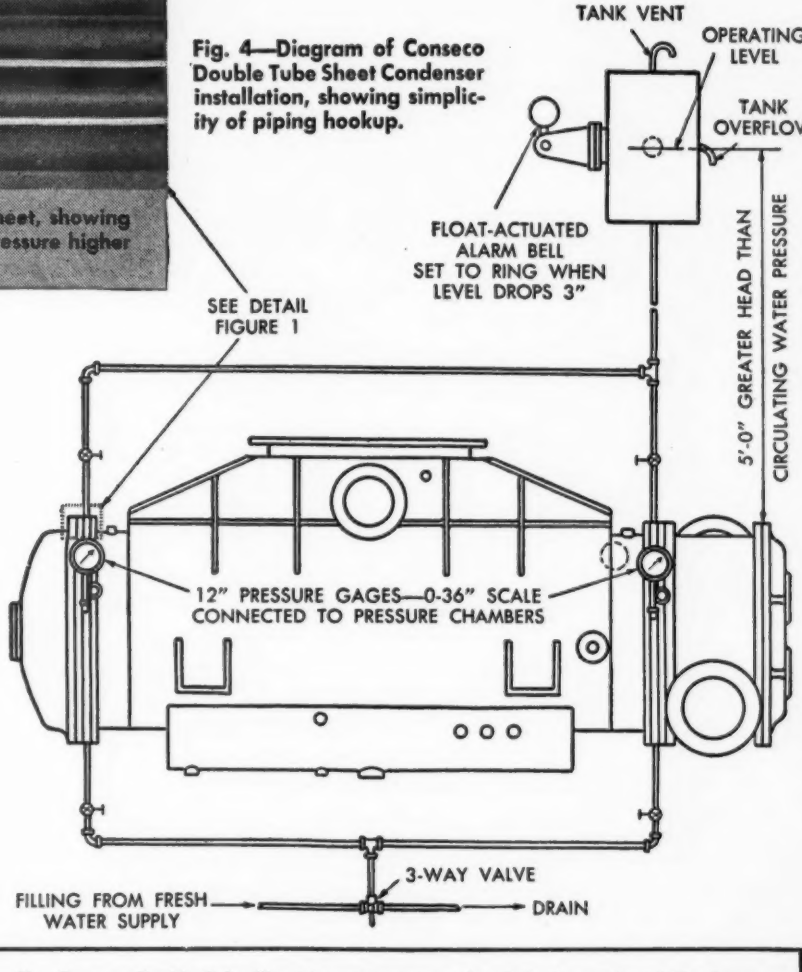


Fig. 3—Leak on steam side causes fresh water to leak into condensate, while unit continues to operate safely.

Fig. 4—Diagram of Conseco Double Tube Sheet Condenser installation, showing simplicity of piping hookup.

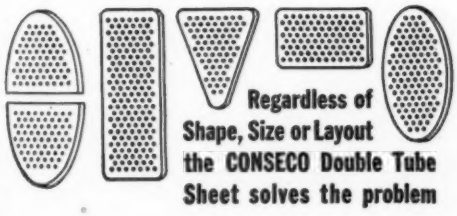

TANK VENT
OPERATING LEVEL
TANK OVERFLOW
FLOAT-ACTUATED ALARM BELL SET TO RING WHEN LEVEL DROPS 3"
SEE DETAIL FIGURE 1
5'-0" GREATER HEAD THAN CIRCULATING WATER PRESSURE
12" PRESSURE GAGES—0-36" SCALE CONNECTED TO PRESSURE CHAMBERS
3-WAY VALVE
FILLING FROM FRESH WATER SUPPLY
DRAIN

## *Designed for all heat exchangers* OLD and NEW

The new Conseco Double Tube Sheets are available for replacing existing ordinary tube sheets, or can be incorporated in your new heat exchangers.

The savings in time, money, and outage, plus the assurance of knowing definitely when and where leaks occur will more than repay the cost of Conseco Double Tube Sheets.

Send for an estimate.



**Regardless of Shape, Size or Layout the CONSECO Double Tube Sheet solves the problem**

CONSECO

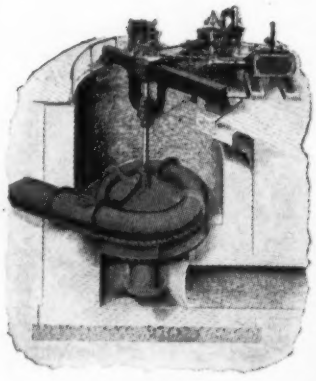
The Conseco Double Tube Sheet is another example of the ingenuity of Condenser Service & Engineering Co., Inc., who produce such outstanding developments as: **Wizard Condenser Injectors** • **Flowrite Tube Inserts** • **Condenser Air and Erosion Eliminators** • **Detectaleak Tube Testers** • **Hydrodynamic Shock Test** • **Fibre Condenser Plugs** • **Conseco Condenser Compound** • **Light Steel Water Boxes and Heads**, rubber or lead-lined • **The Simple and Practical Condenser**; condensate same temperature as vacuum; glass lights in water boxes and heads • **Conseco Condenser Packings**; fibre, metallic, corset lace • **Conseco Ferrules.**

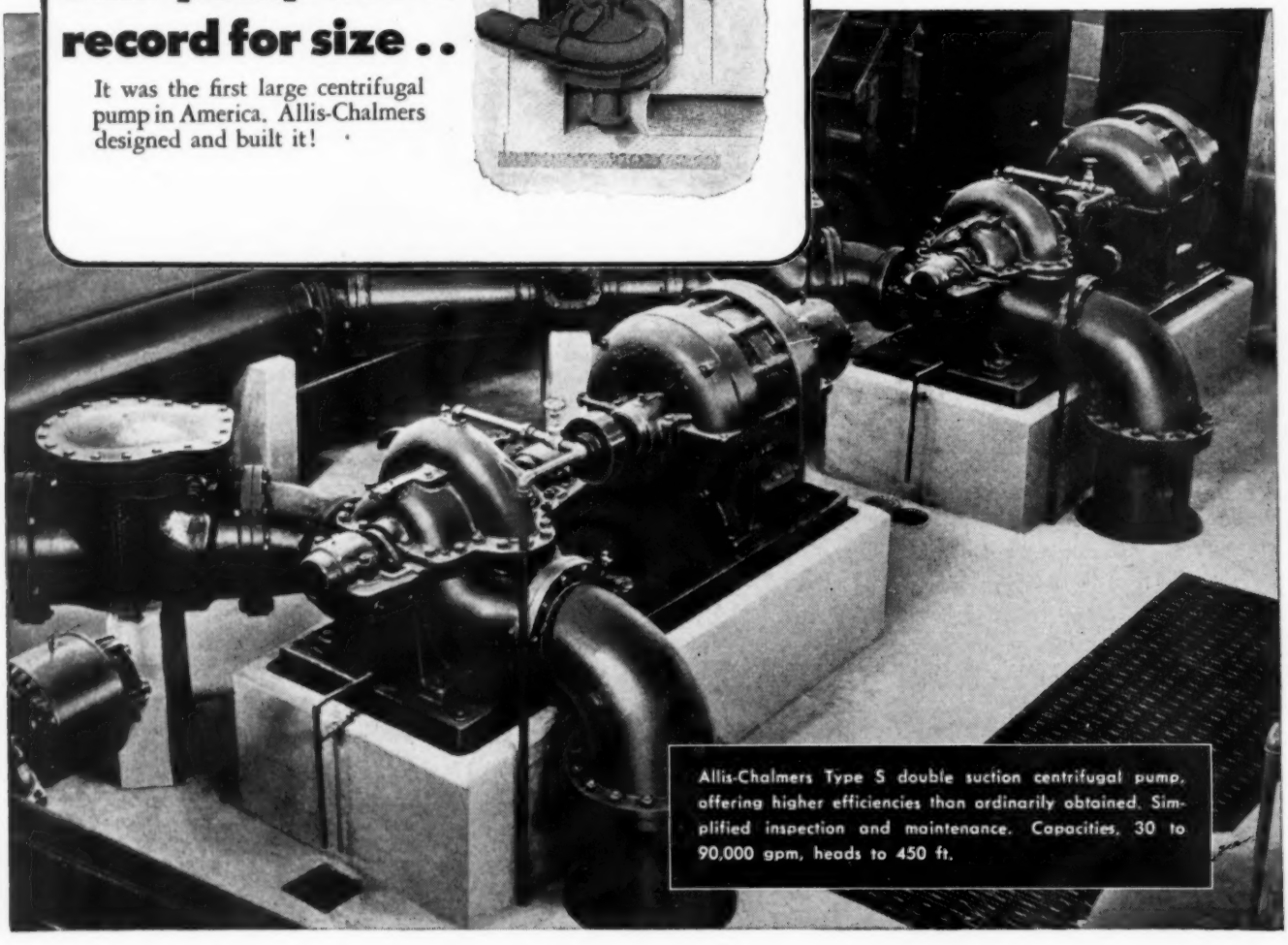
Send for our new condensed catalog for a full list of Conseco products.

# IN 1885:

## This pump set a record for size..

It was the first large centrifugal pump in America. Allis-Chalmers designed and built it!





Allis-Chalmers Type S double suction centrifugal pump, offering higher efficiencies than ordinarily obtained. Simplified inspection and maintenance. Capacities, 30 to 90,000 gpm, heads to 450 ft.

# EVER SINCE: Allis Chalmers pumps have been setting records for efficiency!

IN BOSTON and other large cities, for example, Allis-Chalmers sewerage pumps have set world records for economy. The same unsurpassed engineering talent and experience that produced these pumps have developed and perfected the pumps you require today: Pumps to handle water, gasoline, abrasive liquids or semi-solids — pumps to handle great volumes or high pressures — pumps of every capacity from 10 gpm to 635,000 gpm! And, Allis-Chalmers also makes the motors to drive them — supplies complete, integrally designed pumping units, and assumes undivided responsibility for their performance. For more details, call your nearest A-C office or write for Bulletin 6059-C. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2189

*Centrifugal Pumps by* **ALLIS CHALMERS**

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

# ARMSTRONG UNIT TRAPPING* *cuts fuel costs*

PACIFIC NUT OIL COMPANY
Producers of Vegetable and Nut Oils and Meals
4615 BANDINI BOULEVARD
LOS ANGELES, CALIFORNIA

April 25, 1946

Guy L. Warden,
209 West 12th St.,
Los Angeles (15), Calif.

Attention: Mr. John Ward

Gentlemen:

We have just completed making an analysis of the savings realized by the installation of Armstrong Steam Traps on fifteen Anderson Expeller Tempering Troughs, and thought you would be interested in the results of same.

The Steam Traps were installed during the last week in February; we therefore made a comparison of the month of February with the first 28 days of the month of March, with the following results:

| | | |
|---|---|---|
| Fuel Consumption | --- | 30.00% less |
| Water Consumption | --- | 65.00% less |
| Extraction of Oil from material being crushed | --- | 0.50% more |

At the time of installing the Steam Traps, we also increased the size of the tempering troughs from five-foot to ten-foot, thus making the above savings all the more remarkable.

Truly yours,
PACIFIC NUT OIL COMPANY
W. D. Horne
W. D. Horne, Superintendent

***ARMSTRONG UNIT TRAPPING**

**WHAT?** It is providing an individual trap of correct size and type for each separate steam condensing space.

**WHY?** Prevents short-circuiting, air locking, water pockets, sluggish drainage. Removes both air and condensate.

**WHERE?** Every place where steam is used.

**WHEN?** The sooner the better.

**HOW?** See your local Armstrong representative, or write.

ARMSTRONG

## *boosts output...*

The experience of the Pacific Nut Oil Company in cutting costs and boosting output through the use of Armstrong Traps is not unusual. Eastern Box Co., Baltimore, Md., estimates fuel savings of 20% . . . Ralph L. Smith Lumber Co., North Kansas City, Missouri, cut more than six hours off time required to treat battery separator plates . . . Kerber Packing Co., Elgin, Ill., reduced rendering time in jacketed kettles 25%.

If you are interested in getting the benefits of Armstrong Traps and the Armstrong Unit Trapping, see our local representative at once. Complete information on request.

**ARMSTRONG MACHINE WORKS**
**812 Maple St., Three Rivers, Mich.**

# a+b+c+.....n=VU
# a complete answer to the steam needs of industry

Though you may vary the factors according to the conditions of any specific installation, you will find that every combination of industrial steam requirements can be answered by the VU Unit and its associated designs.

One important reason for the versatility of this basic design, originated by Combustion Engineering in 1925, is the principle of symmetry which makes every longitudinal section through the unit the same as every other.

Think what this means. Since each longitudinal section is identical . . . and the front-to-rear course of the gases assures practically constant temperature and mass flow at any given line crosswise of the unit . . . the performance of each section is identical. Therefore identical sections can be combined to provide the desired capacity at optimum overall efficiency.

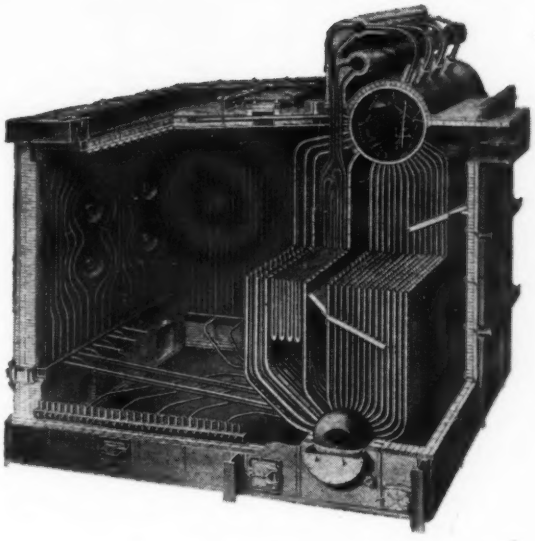
Symmetrical design eliminates lazy tubes since each longitudinal section has the same furnace volume, same evaporative surface, the same amount of water, producing the same amount of steam. Moreover, the uniform release of steam along the entire length of the drum eliminates surging water level and periodic carry-over of water slugs with the steam.

These operating advantages, combined with features assuring dependable service and low maintenance cost, have resulted in the selection of VU Units for installations throughout the United States and Canada and in many foreign countries. Aggregate capacity of these installations is now more than 70,000,000 pounds of steam per hour — a fact which speaks for itself.

The three units here illustrated comprise the VU family. They provide for capacities from 15,000 to more than 300,000 lb per hr, for pressures up to 1000 psi and for steam temperatures up to 900 F, or higher. They are adaptable to the use of any fuel or method of firing. They represent a complete answer to any and every specification of steam requirements in the industrial field. B-141

**COMBUSTION**

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS, ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

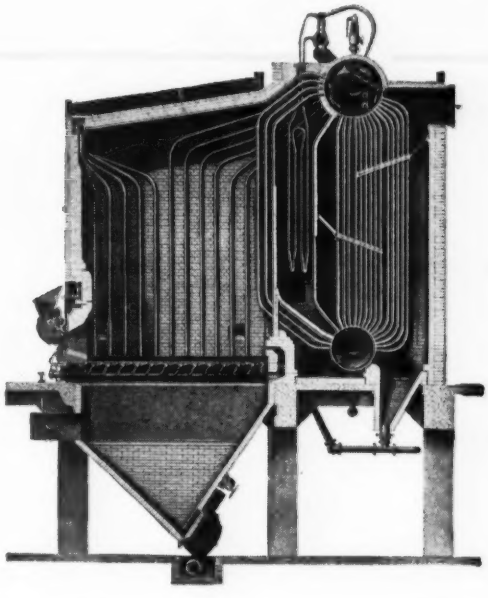


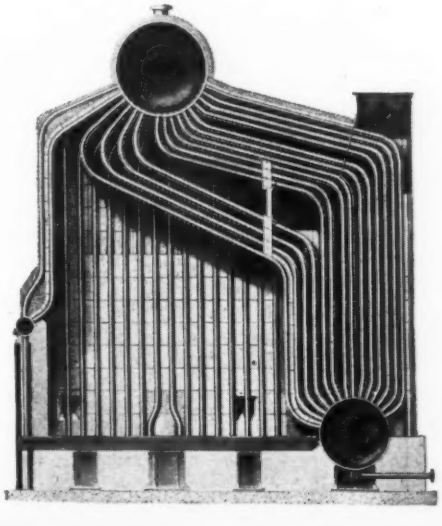
### Type VU Steam Generator (for the higher capacity range)

This unit, the original VU design, may be fired by pulverized coal, oil or gas, or any combination of these fuels. Available for capacities up to 300,000, or more, lb of steam per hr, pressures up to 1000 psi and steam temperatures up to 900 F, or higher. Furnace bottom may be as shown or may be of hopper type. Economizer or air heater surface may be added.

### Type VU Steam Generator (for the middle capacity range)

In this VU design, shown equipped with a C-E Spreader Stoker, the furnace proportions and arrangement of water wall surfaces may be adapted for firing by any type of mechanical stoker. Design is also adaptable for firing by oil or gas. Economizer or air heater surface may be added. Approximate capacity range 25,000 to 100,000, or more, lb per hr.



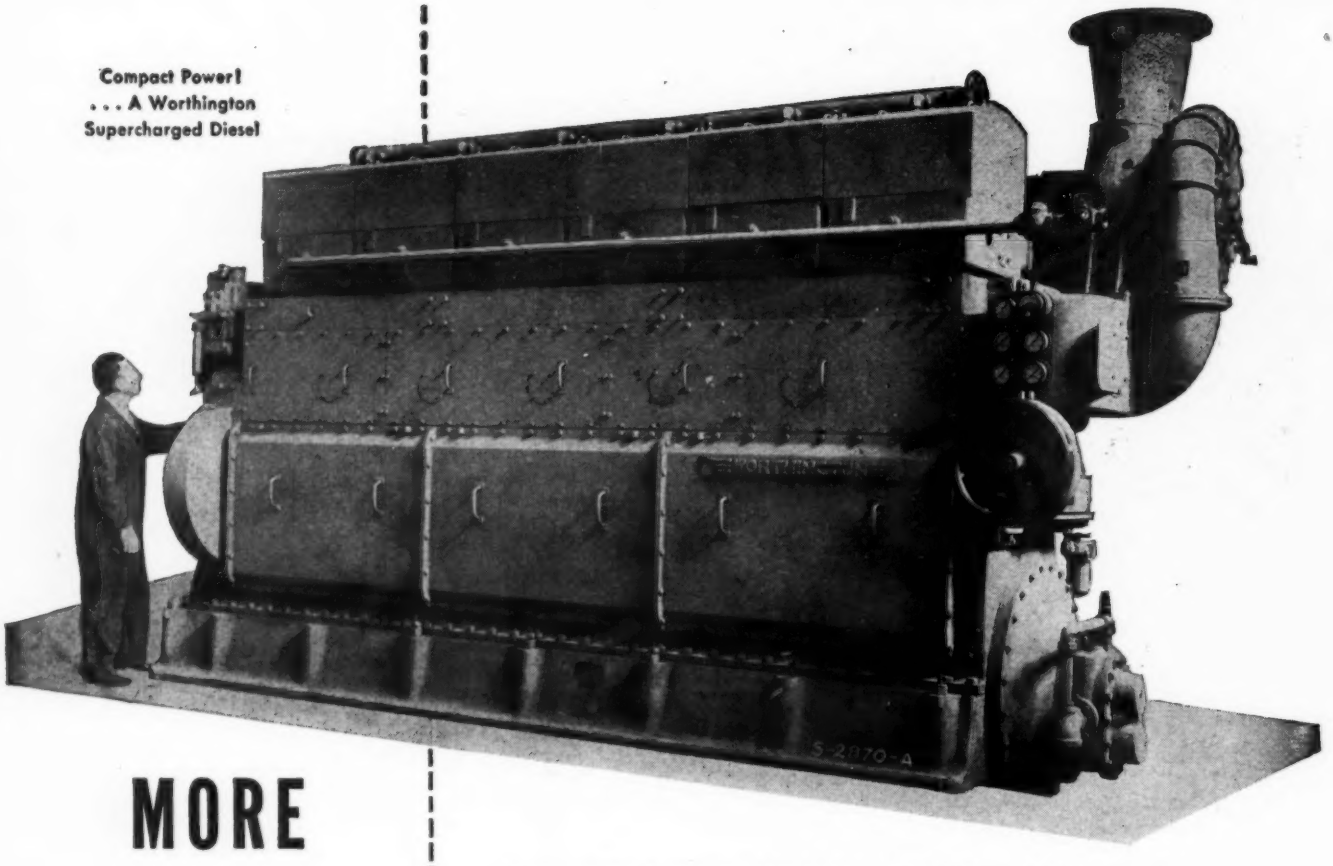


### C-E Package Boiler (for the lower capacity range)

This youngest member of the VU family is designed for industrial load conditions and particularly for plants having small operating and maintenance forces. Capacities range from about 15,000 to 40,000, or more, lb per hr. Firing may be by spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other, should fuel market conditions make this desirable.

E N G I N E E R I N G
200 MADISON AVENUE, NEW YORK 16, N. Y.

Compact Power!
. . . A Worthington
Supercharged Diesel



# MORE

***KILOWATT HOURS PER GALLON OF FUEL OIL***

# LESS

***INSTALLATION MAINTENANCE AND LUBRICATION COSTS***

***. . . with Worthington 4-cycle Supercharged Diesels***

In a tropical climate, furnishing electricity for motor-driven refrigeration compressors is one of the toughest engine-jobs going — calling for completely dependable, uninterrupted output. That's why the following record of a Typical Worthington Diesel installation for a big Central-American refrigeration plant is of vital interest to every power user. At the end of 34 months of continuous operation, three Worthington SDD-6 Diesels (500 kw. supercharged) produced these results:

| | |
|---|---|
| Hours of operation, combined | 43,764 |
| Average kilowatt hours per year, combined | 4,993,633 |
| Running-engine-capacity factor | 64.7% |
| Average kilowatt hours per gallon of fuel oil | 14.08 |
| Total Annual maintenance cost per engine H.P. | 33.8 cents |

Here's 10% to 15% more kilowatt hours per gallon of fuel oil, with minimum upkeep and replacement costs! Then there's 25% lower lubricating oil consumption . . . big reductions in building space, foundation materials and installation labor . . . adding up to tops in Diesel efficiency, with savings all along the line!

Today, Worthington installations of like capacity supply entire communities with electricity, while all over the world Worthington Diesels meet industry's needs for continuous, trouble-free, economical power.

Write for details . . . and further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

**WORTHINGTON**

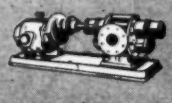
E7-2

YOUR PARTNER IN POWER PROGRESS

**WORTHINGTON-BUILT AUXILIARIES**

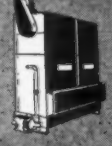
Diesel engines, 150 to 3,290 hp . . . gas engines, 175 to 3,500 hp . . . dual fuel engines, 150 to 3,290 hp.

Air King Compressors



Oil Transfer Pumps

Cooling Water Circulating Pumps



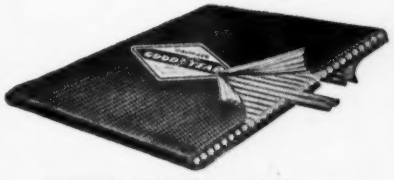
Evaporative Type Engine Water Cooler

GTM-Specified

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

# THE BIG 3 FOR BIG SAVINGS

YOU'LL SET NEW PERFORMANCE STANDARDS WITH THESE OLD RELIABLES



**ENDLESS COMPASS BELTS,** for compressors, generators, fans, line shafts and other heavy-duty drives. In many installations they have outlived and outperformed ordinary belts three and four to one.

**STYLE M STEAM HOSE** for all steam service up to 100 pounds' pressure. Tough, flexible construction with tube specially compounded to hold saturated steam. Tough cover to resist abrasion.

**EMERALD CORD AIR HOSE** — a truly "super" air carrier. Lighter than ordinary hose, yet far tougher, stronger, longer-lasting, thanks to new construction. Oil-resistant tube. Best buy for heavy-duty service.

HERE are three standout performers that have proved their worth in countless installations. They exemplify the economy, the long life, the tried-and-true dependability you get from all Goodyear Industrial Rubber Products.

Whatever your rubber problem, you'll find the answer in a Goodyear product, specified in the size and construction best suited to your needs by the G.T.M. — Goodyear Technical Man. For on-the-spot advice by this friendly counselor, write: Goodyear, Akron 16, Ohio or Los Angeles 54, California.

**FOR HOSE, BELTING, MOLDED GOODS, PACKING, TANK LINING,** built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass, Emerald Cord—T.M.'s The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

# *Fully*

## ...THE HAGAN DIFFERENTIAL MASTER

You get the full benefit of automatic combustion control only when you have a combustion control system which is *fully* automatic.

You are not getting full benefit if manual adjustment is needed when there is a change in fuels, when a pulverizer is shut down, when coal gets wet, or when feeder characteristics change. You lose not only the time required to make the adjustment, but also the time spent in watching for the need of it.

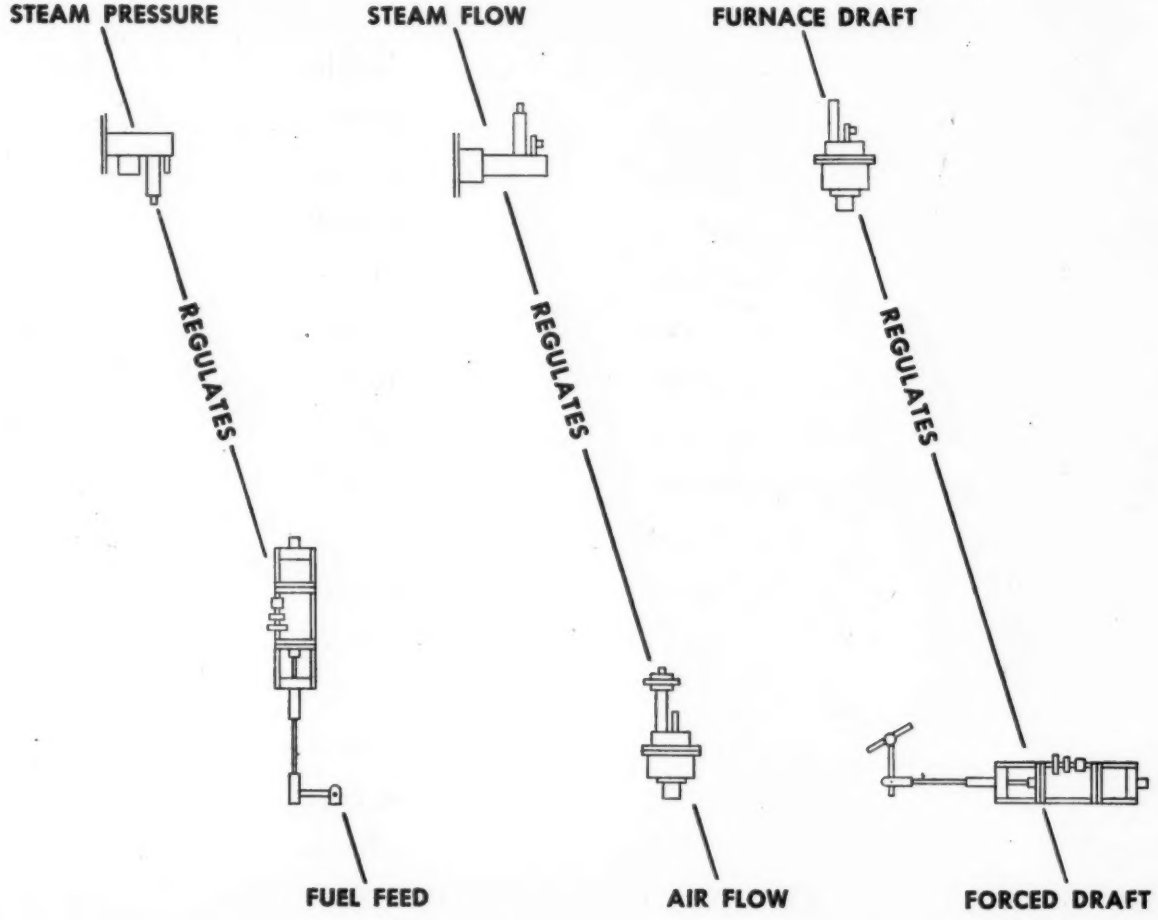
The Hagan Differential Master method of combustion control *is* fully automatic. The method employed is simple. A Hagan Master Sender, which is sensitive to steam header pressure, controls heat input in accordance with demand. A Hagan Differential Master Sender, measuring steam flow, regulates air flow. The boiler unit itself thus becomes a calorimeter of heat input.

The Hagan Differential Master system is in service with boilers burning gas, oil, pulverized coal and various combinations of these fuels. Boiler sizes in these installations range from 30,000 lb./hr. at 200 p.s.i. to 650,000 lb./hr. at 1,800 p.s.i. In every situation it has proved to be accurate, reliable, and easy to operate.

Hagan engineers will be glad to show you the advantages offered by the Differential Master method in your plant. Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

# automatic

## METHOD OF COMBUSTION CONTROL




## HAGAN CORPORATION

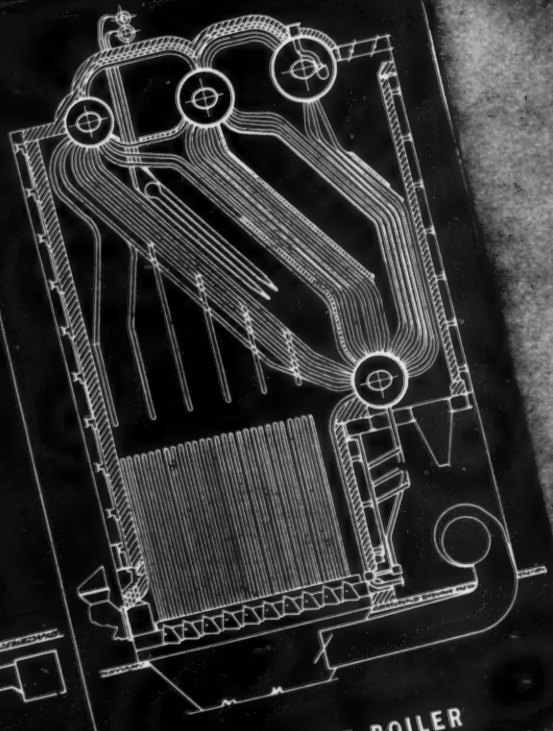
HAGAN
HALL
BUROMIN
CALGON

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

# Vogt Steam

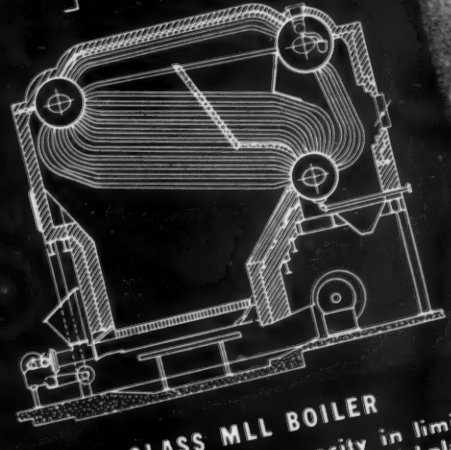
SECTIONAL HEADER BOILER

Sinuous forged steel headers feature this straight tube, cross-drum type generator. Staggered tubes achieve high heat transfer rate and insure efficient operation.



CLASS LE BOILER

Unsurpassed for quick steaming at all ratings, this four drum, bent tube type will carry high overloads with high efficiency.

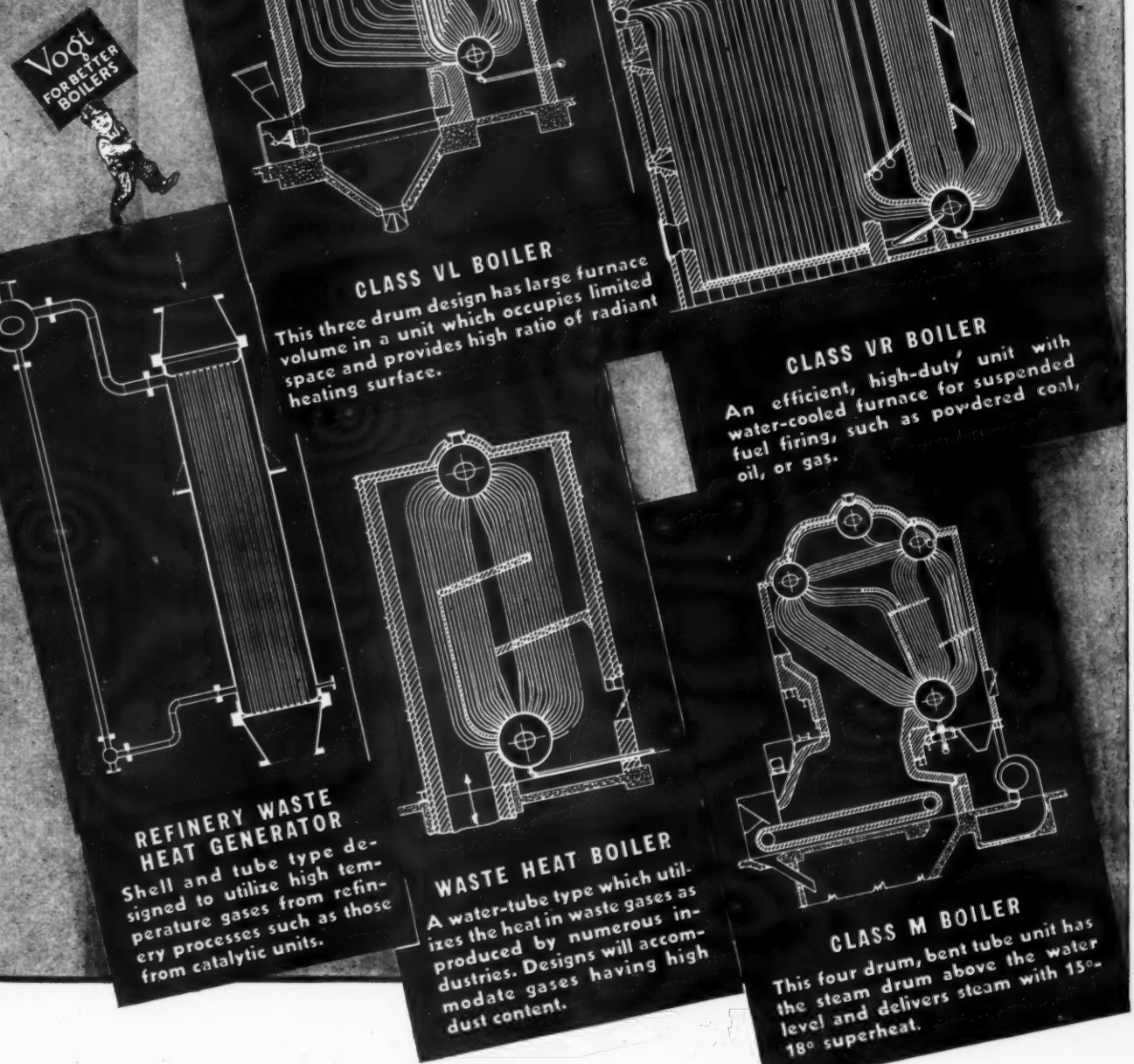


CLASS MLL BOILER

Provides maximum capacity in limited headroom. Widely used in industrial plants, institutions, etc., having moderate processing or power loads, and for heating.

HENRY VOGT MACHINE CO., Inc.

# GENERATING UNITS




**CLASS VL BOILER**

This three drum design has large furnace volume in a unit which occupies limited space and provides high ratio of radiant heating surface.

**CLASS VR BOILER**

An efficient, high-duty unit with water-cooled furnace for suspended fuel firing, such as powdered coal, oil, or gas.

**REFINERY WASTE HEAT GENERATOR**

Shell and tube type designed to utilize high temperature gases from refinery processes such as those from catalytic units.

**WASTE HEAT BOILER**

A water-tube type which utilizes the heat in waste gases as produced by numerous industries. Designs will accommodate gases having high dust content.

**CLASS M BOILER**

This four drum, bent tube unit has the steam drum above the water level and delivers steam with 15°-18° superheat.

**1000 WEST ORMSBY STREET**
**LOUISVILLE 10, KENTUCKY**

**BRANCH OFFICES:** *New York • Chicago Cleveland • Philadelphia • Dallas*

# FOR REMARKABLY LONG LIFE IN HIGH-

# *Specify* CORONOL-GEOPRENE

*Trademark Reg. U. S. Patent Office*

**Both the insulation and jacket of Coronol-Geoprene give far longer service than the best prewar compounds. This is the finest non-leaded cable we can make for high voltages.**

## CORONOL INSULATION BEATS RUBBER 10 WAYS

Coronol has a custom-built molecular structure, the base of which is butyl rubber. It gains its superiority by freedom from the excess double bonds (or high unsaturation) that subject natural rubber to oxidation and aging. It is essentially inert to the action of heat, moisture, ozone, sunlight, and oxidizing agents, thereby slashing normal replacement needs (see table at right).

## GEOPRENE JACKET ADDS 3-WAY PROTECTION

**2½ times the tear resistance** of natural rubbers is shown in test results of Geoprene, a special G-E formulation containing approximately 60 per cent neoprene. This added toughness gives Geoprene over twice the resistance of rubber jackets to mechanical wear and cutting.

**105 per cent better aging properties** than required by industry specifications are proven in air-oven and oxygen-bomb tests, assuring longer life, especially to cables exposed to glaring sunlight.

**Flame resistance** is incorporated in the Geoprene jacket, adding a final measure of safety and serviceability.

With these advances in both insulation and jacket, we know that Coronol-Geoprene will give you outstanding service and lower costs where high-voltage rubber-type cable is used.

Recommended applications and descriptive information are included in Bulletin GEA-1788. For your copy, call your nearest G-E representative, or write to General Electric Company, Apparatus Department, Schenectady 5, N. Y.

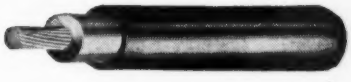
# - VOLTAGE RUBBER-TYPE CABLES,

# CABLE

Coronol-Geoprene is one of six modern cables that are mass produced and authorized for warehouse stock. Standard designs permit quicker delivery and a lower price than special types. Each cable offers special advantages in its recommended applications. Detailed information is given in the bulletins listed below.

***INTERLOCKED-ARMOR***

**For overhead power distribution throughout the plant. Needs no conduit, speeds installation. Bulletin GEA-4507.**



***VERSATOL*-GEOPRENE***

**For low-voltage distribution and branch circuit wiring to motors and controls. Resists wear, moisture and heat aging. H. B. 1240, P. 3.**

***FLAMENOL****

**For low-voltage wiring. Its chemically inert insulation resists water, cutting oils, acids, and alkalies, and is flame resistant. Bulletin GEA-4352.**

***VARNISHED-CAMBRIC LEADED***

**For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. Bulletin GEA-2623.**

***GEOPRENE PORTABLE***

**For power to portable shovels, pumps, construction machinery where resistance to rough handling and excessive flexing is needed. H. B. 1261.**

**Trademark Reg. U. S. Patent Office*

**FIGURES THAT MEAN LONGER CABLE LIFE**

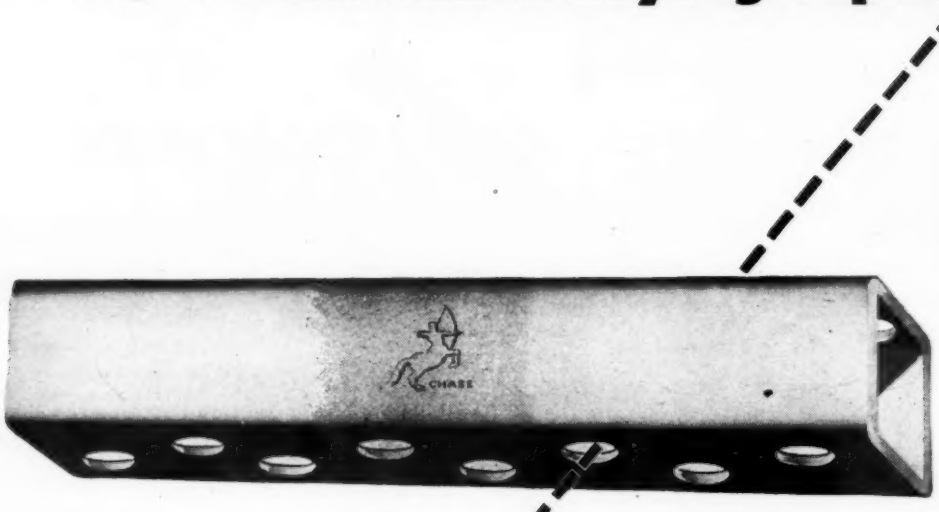
| Properties | Coronal (Typical values) | Prewar Coronol-natural rubber (Typical values) | Ipcea* Requirements |
|---|---|---|---|
| **Original Physicals** | | | |
| Tensile lbs/sq in. | 750 | 550 | 450 |
| Per cent elongation | 600 | 300 | 250 |
| **7 days 70 C Geer Oven** | | | |
| Tensile lbs/sq in. | 700 | 450 | 400 |
| Per cent elongation | 525 | 225 | 200 |
| **48 hours 70 C Oxygen Bomb** | | | |
| Tensile lbs/sq in. | 675 | 475 | 400 |
| Per cent elongation | 525 | 240 | 200 |
| Cold Bend | −60 C | −15 C | −10 C |
| Ozone Resistance | very good† | good | 3 hours |
| Power Factor | .010 | .030 | .050 |

*Insulated Power Cable Engineers Association Specification for Ozone-Resistant Type Insulation.
†Many samples have withstood 72 hours exposure.

# GENERAL ELECTRIC

502-62

# For HIGH current-carrying capacity...




# CHASE ventilated Bus Conductor

NOTICE the ventilating holes in top and bottom faces of this Chase Copper Bus Conductor. They provide internal cooling by *natural convection,* which increases current-carrying capacity.

The one-piece square copper tube, first developed commercially by Chase, gives great mechanical strength in all directions... simple one-piece construction saves installation time and labor.

When such features are combined with the basic advantages of *copper,* you can understand why electrical engineers prefer Chase Bus Conductors for AC bus installations.

The Chase Electrical Handbook contains complete information on Square Tube and other Chase Bus Conductor forms. For your copy, write (on company letterhead) to Dept. PO-67.

**Chase** *the Nation's Headquarters for* **BRASS & COPPER**

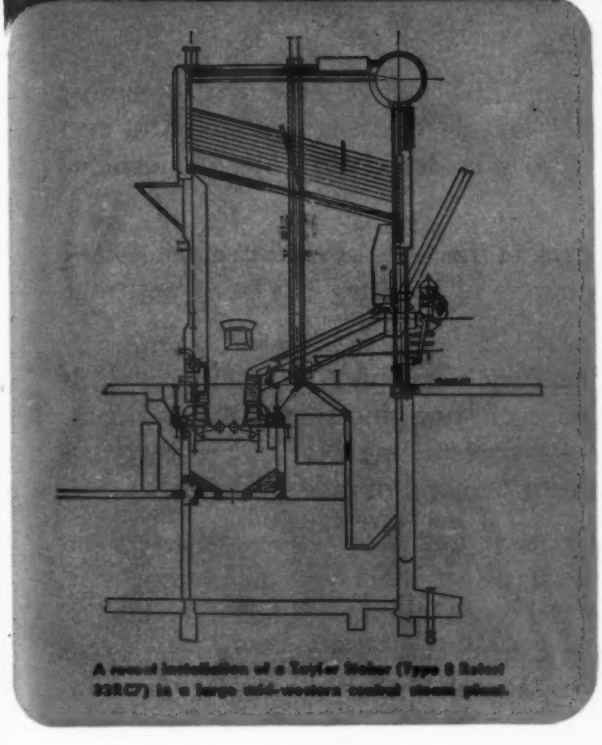
WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Sales Office Only)

# NOT FINICKY ABOUT ITS FUEL!

The Æ Taylor Stoker, like this soaring scavenger, is not "fussy" about what it consumes. Its fuel-versatility enables you to feed it a wide variety of types and sizes of coal which often means more efficient, thorough combustion with a lower grade of fuel than you are now using. This obviously results in important savings to you—a significant feature you should not overlook when selecting fuel-firing equipment for your power plant operations.



A recent installation of a Taylor Stoker (Type E Rated 325C°) in a large mid-western central steam plant.

## WATCH THE TREND!

**It is quite probable that you are already acquainted with the exclusive Taylor features that make this fuel - flexible stoker first choice with buyers wherever underfeed stokers are used. Throughout industry, the trend is toward Taylor for both original and repeat installations —Taylor is the time-tested, proven, economy stoker.**

**Better air flow and precision control feed mechanism are but a few of the advantages that aid in giving you efficient low-cost steam generation. With simplified construction throughout, there are fewer moving, longer wearing parts. These outstanding improvements are backed up with over 40 years of engineering "know how" with emphasis placed on features that mean efficient, automatic, low-cost steam production.**

**Join the hundreds of engineers, plant superintendents and purchasing agents who specify Taylor for *their* power plant equipment. They know—*it's the leader.***

UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

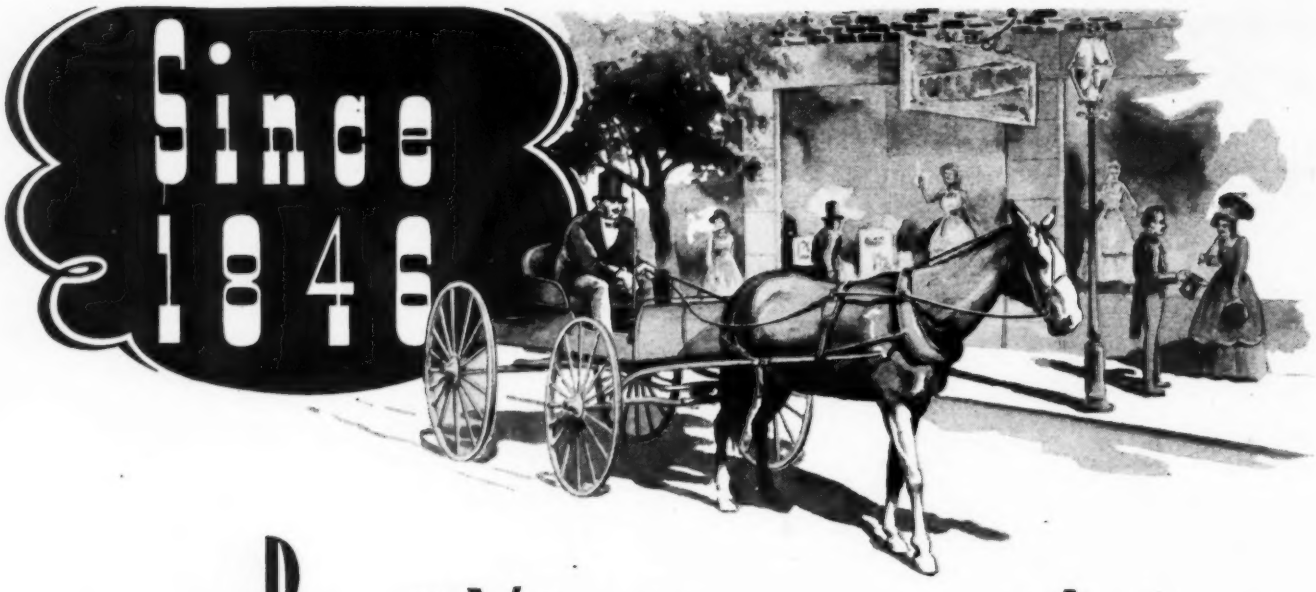
**If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!**

# TAYLOR STOKER

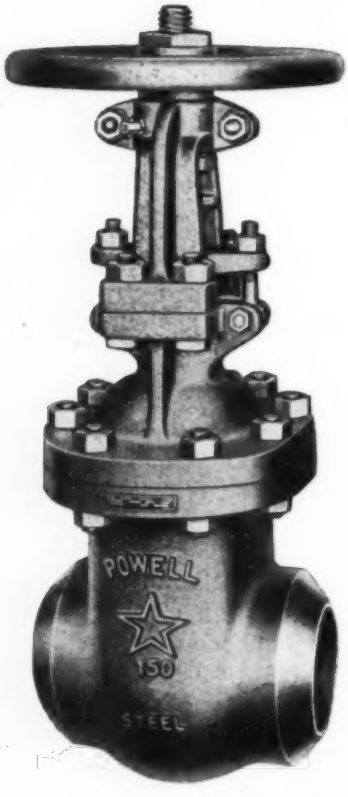
Æ

## AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.




# Powell Valves have served Industry
## ...and served it well.




Class 150-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc.

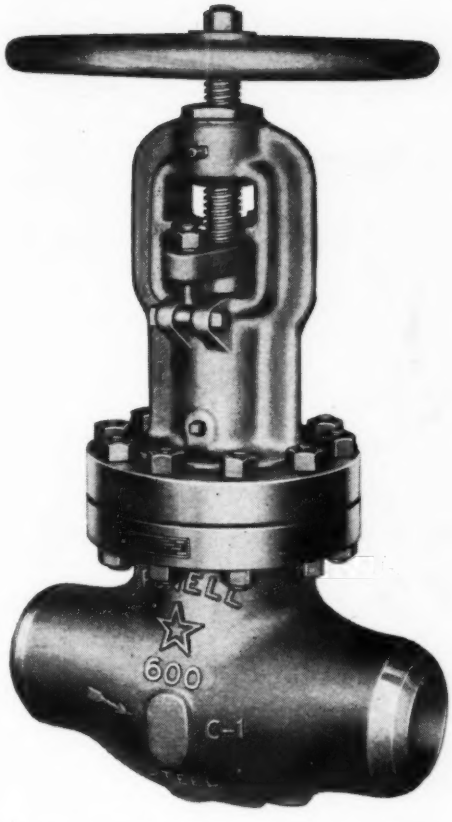
'Way back in the "horse and buggy days", the first regrinding globe valve was produced and patented by Powell. And ever since then Powell has been a leader in the field of industrial flow control equipment.

As amazing as the changes in methods of transportation have been since 1846, the progress of industry has been well nigh incredible.

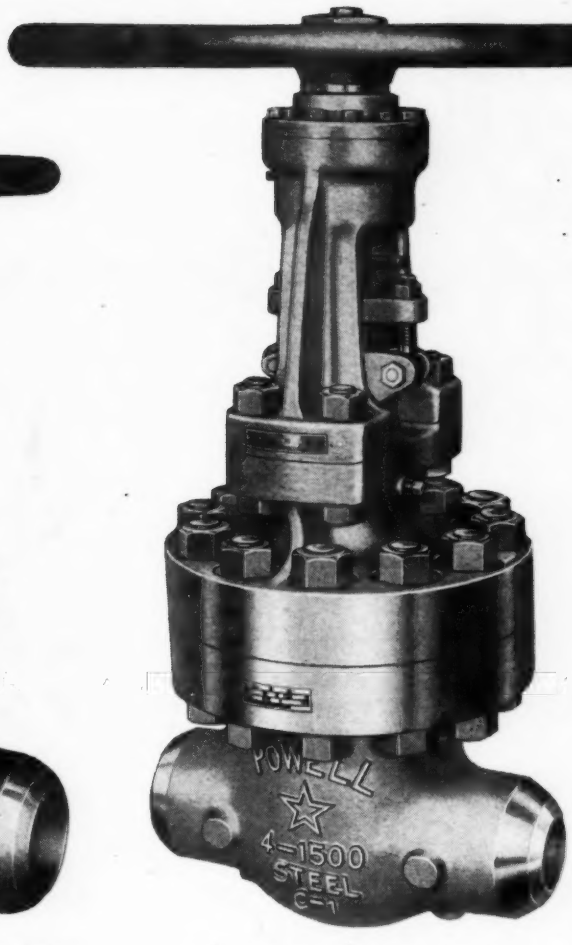
Through more than a century of keeping pace with the flow control requirements of each new industrial development, Powell has built such a complete line that today there's a Powell Valve to meet every demand of modern industry.

The line now includes Bronze and Iron Valves of every required type, design and size; Cast Steel Valves of every type, in pressure classes from 150 to 2500 pounds, inclusive. And, to meet the demands of the Chemical and Process Industries for corrosion resistant valves, Powell makes a complete line, including many special designs, in the widest range of pure metals and alloys ever used in making valves.

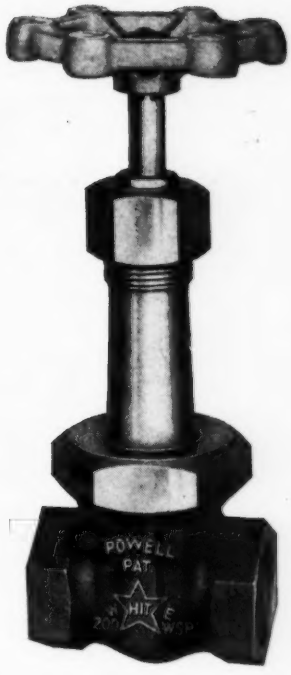
POWELL




Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.




Class 1500-pound Cast Steel Gate Valve, with welding ends, outside screw rising stem and bolted flanged yoke.




Small size 200-pound Bronze Gate Valve for steam, water, oil or gas. Has inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze disc.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

Class 600-pound Cast Steel Swing Check Valve, with welding ends and bolted cap. Disc has ample lift to permit full, straight-way, unobstructed flow through the valve when wide open.

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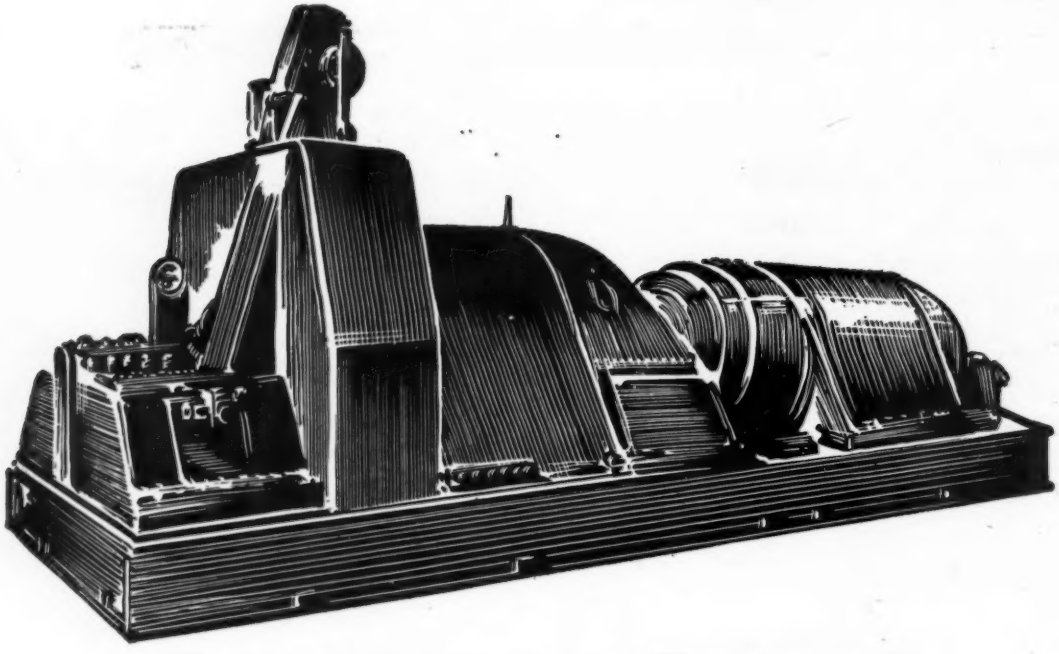

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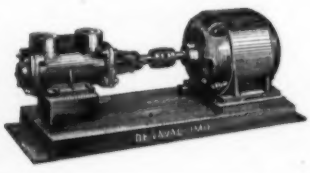

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## JUNE 1947

VOLUME 91, NUMBER 6


A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
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ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

### FEATURE ARTICLES


MODERN PLANT SURVEY: a special section

- Station equipment patterns for record capacity increase .... 64
- Technical data on new central stations .... 66
- Typical industrial power plants .... 68
- Hydroelectric power development .... 73
- Technical data on new hydro units .... 74
- List of government hydro plants .... 78

Energy-load and load duration curves save hours of calculation .... 79

Pioneer in the use of triethylene glycol for air sterilization .... 83

Gas-turbine possibilities in the stationary power-plant field .... 86

Supercharging gas-burning diesel yields maximum performance .... 90

Intelligent planning cuts fuel losses, raises power factor .... 93

John C Porter, a personality in the power field .... 95

Map of government hydro plants .... 98

Vacuum rids cold water of dissolved gases; saves pipelines .... 99


### THE OPERATING ENGINEER


Cut your smoke by increasing turbulence .... 103

Photocell improves sander-dust burning .... 105

Practical aids .... 106 Math tips .... 118

Reader's problems .... 110 How to — .... 120

Pump Q & A .... 114 Argument corner .... 124


### OTHER DEPARTMENTS


New equipment .... 126 George Edwards .... 136

The engineer's bookshelf .... 130 Power news .... 138

Data sheet .... 134 New bulletins .... 186a


*Cover photo, courtesy West Penn Power Co*


VOLUME 91, NUMBER 6 • ABC • ABP •


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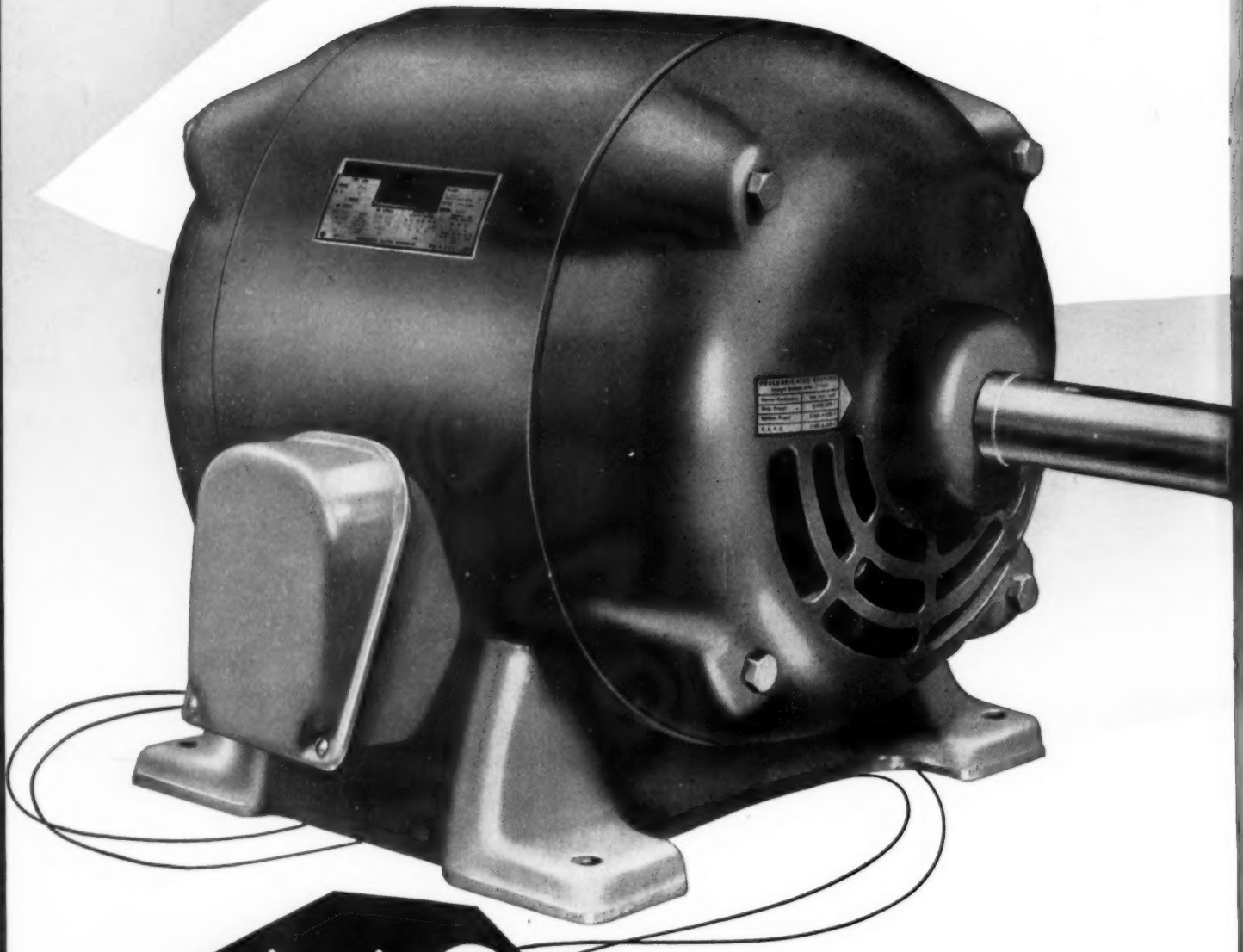
# The most important advance in motor design in 58 YEARS... th



Features and improvements demanded most by users ALL WRAPPED IN A SINGLE PACKAGE

When Westinghouse engineers began designing a postwar motor they abandoned the concept that all motors must be cousins. Instead, they asked electric motor users *what they wanted* in motors . . . features they couldn't buy in any one motor.

These features demanded most by motor users are *all* incorporated in the new Life-Line Motors:

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# the New WESTINGHOUSE Life-Line MOTOR

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Life-Line, today, offers industry a truly all-steel protected motor. All exposed surfaces are HEAVY STEEL—frames of even the smallest sizes are 3/8" thick.

More compact power is packed in Life-Line. For example, on the 284 frame, size has been reduced 35%, although NEMA mounting dimensions have been maintained . . . starting torques are as much as 134% greater per pound of motor . . . maximum torques as much as 116% more per pound.

Electrical characteristics have been improved . . . new materials and new winding techniques give increased protection against electrical failure. And sealed, pre-lubricated bearings do away with need for greasing or attention for at least five years!

The Life-Line Motor, as a result, represents the biggest single step forward in design and construction since the invention of the electric motor 58 years ago. Life-Line Motors are now reaching the drives of industry by the thousands, but are not yet available in quantities to meet the unprecedented demand. So, look over Life-Line advantages now with an eye to your future requirements. Your local Westinghouse office can give you full details, or write to Westinghouse Electric Corporation, P. O. Box 2025, Buffalo 5, N. Y.

★ ★ ★

*Life-Line Motors are now in production at the new Westinghouse Motor Works in Buffalo, N. Y. This plant is laid out, tooled and equipped to fully utilize newly developed production processes and techniques on a scale hitherto unequalled in the manufacture of electrical motors.*

J-21406

**LESS SPACE PER HP.** Life-Line Motors occupy less space per horsepower than any other standard motor . . . making it easier to build into machines and install in cramped quarters.

**MORE TORQUE PER LB.** Life-Line Motors give as much as 134% higher starting torque per pound of motor . . . up to 116% higher maximum torque.

**NO LUBRICATION FOR 5 YEARS.** Life-Line Motors need no greasing for AT LEAST FIVE YEARS. Bearings are pre-lubricated . . . sealed against dirt and moisture.

**IMPROVED WINDINGS.** New insulating materials . . . new coil winding techniques . . . new stator slot designs . . . give the Life-Line new record-setting protection against electrical failures.

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Life-Line motors

IN THE MODERN OFFICE BUILDING OF JOHNSON WAX
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in a NEW TYPE OF HEATING
FRANK LLOYD WRIGHT ARCHITECT
WESTERLIN & CAMPBELL CO., HEATING CONTRACTORS
BYERS GENUINE WROUGHT IRON
TUBULAR AND FLAT ROLLED PRODUCTS

# Here's an Advertisement that started a *Revolution!*

This is the tenth anniversary of a revolution in heating.

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Byers Wrought Iron pipe was used . . . and in line with its policy of informing designers and engineers of new developments, A. M. Byers Company ran an advertisement on the subject as the building neared completion. You may have seen it . . . but certainly would never have dreamed of how far-reaching its effects would be.

A flood of inquiries came from technical men, interested in the new method of heating. From this beginning in 1937 the Byers organization collected all available data, developed additional information, and put the result between covers in the first complete, authoritative bulletin on radiant heating. This—and succeeding editions, in which additional facts and findings were included—has been accepted as the "Bible" of radiant heating by thousands of architects, engineers, and heating contractors. In succeeding years, Byers engineers worked with hundreds of designers on specific projects, continued to gather data, and today have accumulated more *complete* and *practical* information on the subject than can be found anywhere else on the globe.

This "experience pool" covers information on the use of radiant heating in almost every type of structure: homes, churches, schools, hospitals, railroad stations, hangars, garages, brooder houses, theaters, telephone exchanges, laboratories, dog kennels . . . the list is far too long to itemize. This wealth of data provides practical answers to almost every question that can arise in connection with radiant heating . . . and it is available to all architects, engineers, and heating contractors interested in applying this modern method of heating.

It is significant that with thousands of installations already made, over 90% of those of which Byers has record have used Byers Wrought Iron pipe. Byers Wrought Iron pipe offers the exact combination of qualities and properties needed for radiant heating: ease of fabrication; high heat emission; almost identical thermal expansion characteristics with concrete, and proved resistance to corrosion. For a "progress report" on this ten years of radiant heating progress, ask for the booklet, "What we have learned from 1000 radiant heating installations."

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**TUBULAR AND HOT ROLLED PRODUCTS**
**ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS**

1946-47

# MODERN PLANT SURVEY

Technical highlights of central-station and industrial plant construction to meet unprecedented postwar load growth; tabulations of engineering features of steam and hydroelectric plants installed in the past year and currently under design

TO MEET POSTWAR LOADS and restore normal margins of reserve, power producers—utility, government and industrial—must add capacity at a rate of 3.5 to 4 million kw each year for the next five years. Can this record-breaking pace be reached?

It is acknowledged that it will not be met this year. As a result of strikes, shortages of materials and components, and other delaying factors, construction this year will fail to equal load growth by 300,000 to 500,000 kw. Thus, the tight situation of the fall of 1946, when the margin between installed capacity and peak load dropped below that of the biggest war year and disappeared entirely in some few areas, will be even tighter this fall.

As construction settles into its stride, however, new capacity may be expected to exceed load growth, probably during 1948. Then a gradual reestablishment of reserves can begin. By 1950 or 1951, if all goes well, something like a normal situation should prevail although many authorities expect rate of building to continue high for several years thereafter.

It would be foolish to view this situation in terms of an imminent and widespread power shortage. It would be equally foolish to view it with false optimism and assume that the stresses and strains of the next few years can be met without the best planning and cooperation of which power engineers are capable. Action along three broad lines seems indicated:

The first step rests with the individual power engineer—specifying standard or duplicate equipment wherever possible. Manufacturers report a gratifying trend in this direction, which cannot be allowed to lag. You as purchaser gain in two ways: (1) elimination of part or all of the engineering time brings delivery dates closer and (2) any single order is less vulnerable to delay resulting from rejection of faulty parts.

The second step also lies with individual companies and engineers: Appraise equipment needs honestly, and allow increases in delivery time where careful study shows them to be safe. Particularly during the next year or two, this measure will permit manufacturers to accelerate schedules for badly needed items in plants and systems where the situation is tightest.

Active cooperation is the basis of step three. It may prove both desirable and necessary for power producers in a given area to set up a committee to: (1) determine priority of equipment needs among plants and systems of the area (2) coordinate delivery of components so lack of a few auxiliaries does not hold up an entire project, and (3) study possible plans for stretching existing capacity, such as use of power-factor-correction equipment, which is relatively easy to obtain and which will reduce system demands.

Foresighted planning and intelligent cooperation have always marked the work of power engineers. These characteristics will make it possible to meet the goal—16 to 20 million kw of new capacity—by the end of 1951.

JUNE, 1947 POWER P W SWAIN, EDITOR

# Station Equipment Patterns Emerge For Record Breaking Capacity Increases

In the table on the following two pages are details of 82 central station units representing roughly one third of the installations started or projected since April 1946. The sudden upswing in electric-power production during the summer of 1946 has touched off the most gigantic growth rate in the history of the central-station industry. The stations listed in this survey represent probably about two thirds of the total units actually under construction or now on the drawing boards.

**Pressures and Temperatures.** Steam conditions are still continuing their trend to the upper values. Fewer units are being built for pressures below 600 psig and more for pressures greater than 1200 psig with the most favored pressures ranging from 800 to 1000 psig.

Temperatures are reaching into the upper limits of present metallurgical possibilities with a concurrent slackening in the utilization of temperatures below 750 F. Three units designed for 1050 F will probably be joined by some others not yet reported. Temperatures of 900 to 950 F continue popular.

**Turbine-Generators.** Largest units reported are two 150,000 kw turbines; from these, capacities range down to 3,000 kw. About 60% are less than 50,000 kw capacity but they represent less than 40% of the total capacity reported. Only six of the units are 1800 rpm, with two at 3000 rpm and the rest running at 3600 rpm.

Of the 81 units reported only five are topping turbines, the remainder being condensing machines. An increasing tendency to use a greater number of bleed points per turbine can probably be attributed to the greater use of higher pressures and temperatures. As many as eight bleed points will be used

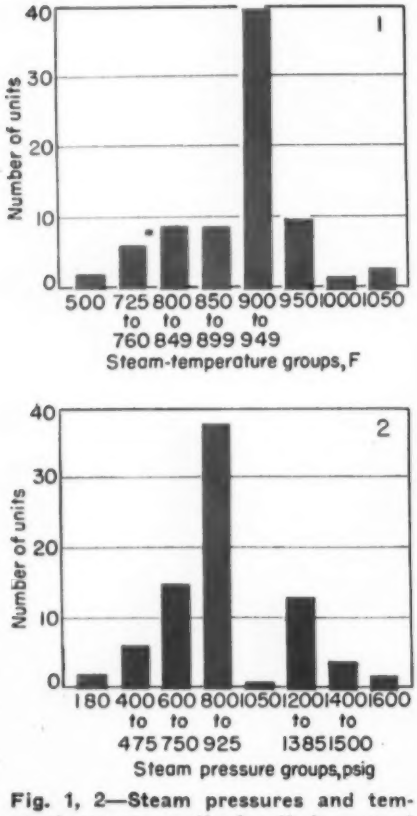



**Fig. 1, 2—Steam pressures and temperatures are continuing their upward trend with most installations using 800-900 psig and 900-950 F conditions**

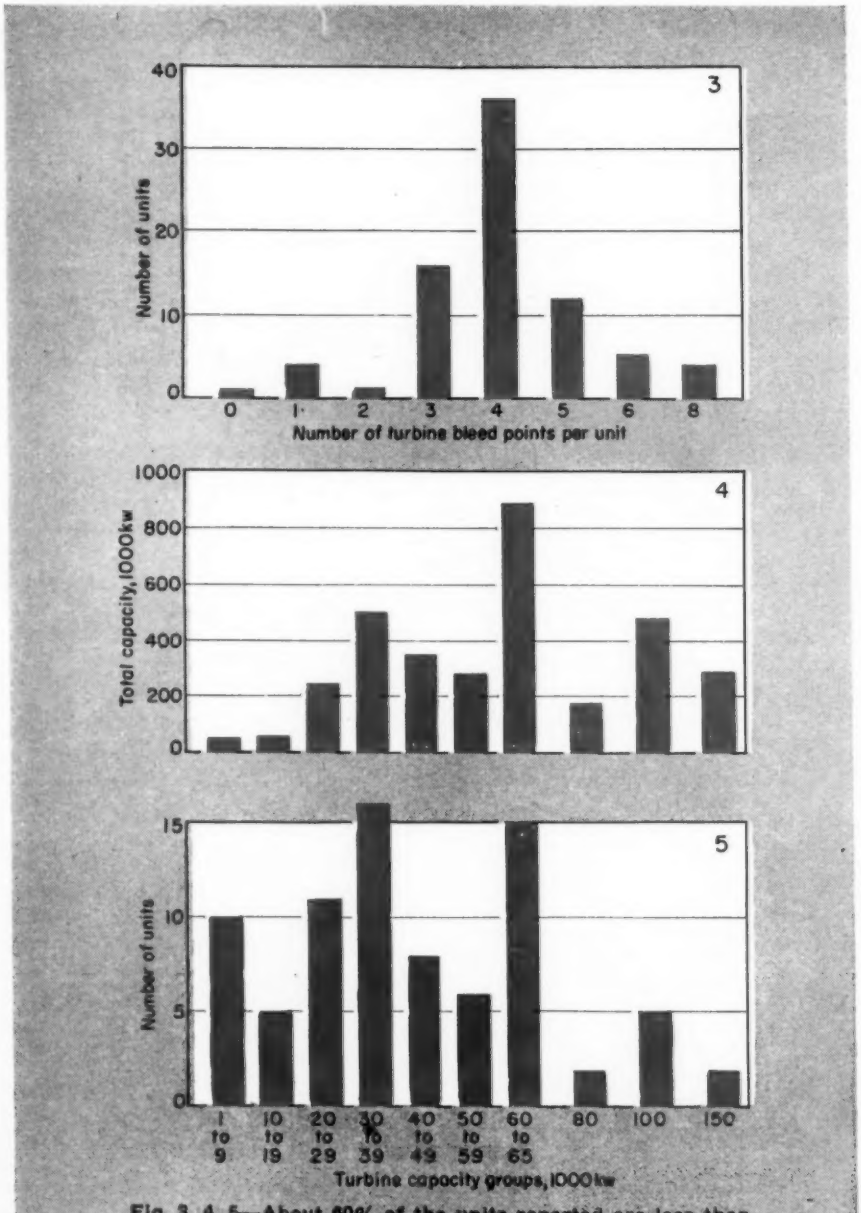



**Fig. 3, 4, 5—About 60% of the units reported are less than 50-mw capacity, but larger units have 60% of all kw. Increasing use is being made of more bleed points per unit**

on at least four machines. However, four bleed points continues to be most frequently used.

Of 80 generators, only 12 are air cooled, the remainder using hydrogen. In the air-cooled group there are one 75 mw, one 50 mw and one 15 mw generator, the rest being less than 10 mw.

**Steam Generators.** Reflecting the effect of greater capacity flexibility on individual systems is the continued trend toward single boiler per turbine designs. Of 80 installations, 58 have one boiler per turbine, 20 have two boilers and only 2 have three boilers.

Largest steaming capacities reported are two boilers of 1,000,000 lb per hr each; from here rated outputs vary down to 45,000 lb per hr minimum. About 65% of the boilers listed are 375,000 lb per hr and smaller but this group represents only about 40% of the total capacity now being installed.

Furnace heat releases for all types of firing average about 22,000 Btu per hr per cu ft; for pulverized-coal firing they average slightly less than 20,000 Btu per hr per cu ft with highest reported value of 26,600 Btu and lowest of 12,300 Btu. Of 102 boilers 59 are pulverized-coal fired and only seven are stoker fired, the remainder being oil, gas or some combination of these two with pulverized coal. Of interest are two boilers reported to be fitted with cyclone burners similar to the experimental installation at Calumet station of the Commonwealth Edison Co. Installations for pulverized coal burning, according to the returns, have about 70% of them designed with dry bottoms, the remainder having slag taps.

About 54% of the steam generators have both air heaters and economizers, 45% have air heaters only and only about 1% have no auxiliary heating surface. Tubular air heaters predominate to the tune of 55%; regenerative types are fitted to 41% of the boilers and the rest are plate type.

**Auxiliaries.** Electric-drive for all auxiliaries continues with only a few exceptions where turbine drives were installed exclusively for boiler feed pumps. Hydraulic and magnetic coupling applications are still a minority.

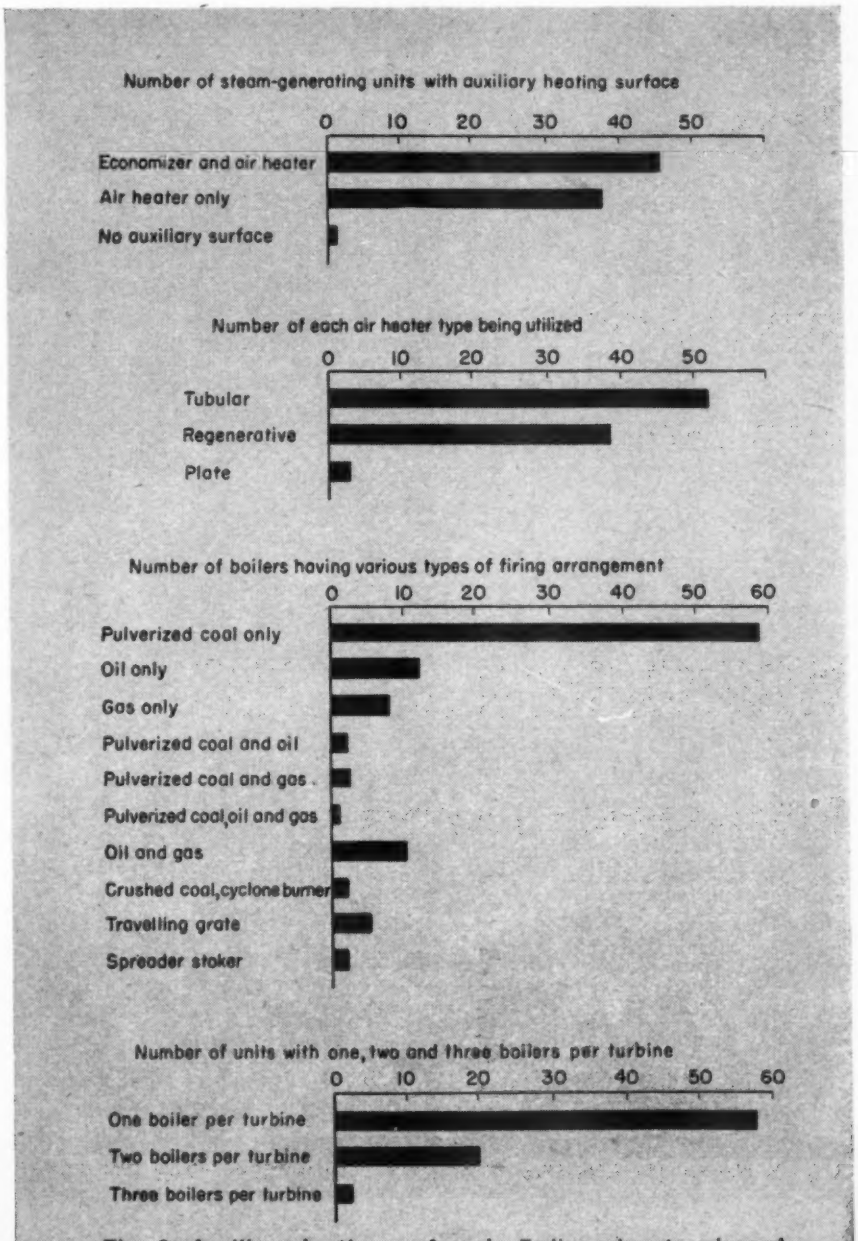

Number of steam-generating units with auxiliary heating surface
0 10 20 30 40 50
Economizer and air heater
Air heater only
No auxiliary surface
Number of each air heater type being utilized
0 10 20 30 40 50
Tubular
Regenerative
Plate
Number of boilers having various types of firing arrangement
0 10 20 30 40 50 60
Pulverized coal only
Oil only
Gas only
Pulverized coal and oil
Pulverized coal and gas
Pulverized coal,oil and gas
Oil and gas
Crushed coal,cyclone burner
Travelling grate
Spreader stoker
Number of units with one, two and three boilers per turbine
0 10 20 30 40 50 60
One boiler per turbine
Two boilers per turbine
Three boilers per turbine

**Fig. 6—Auxiliary heating surface is finding almost universal application on central station boilers. Pulverized coal firing dominates field with stoker firing applied in only few cases**

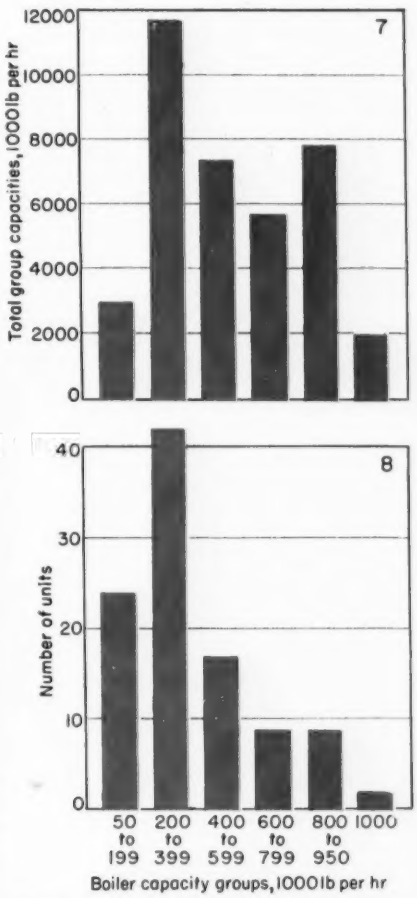



**Fig. 7, 8—About 65% of boilers have less than 400,000 lb per hr capacity, but they have only about 40% of total capacity of all the boilers reported**

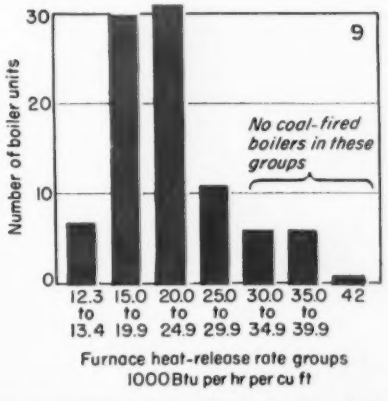



**Fig. 9—More conservative furnace design indicated by lower heat releases**

# Typical Central Stations Installed and

Compiled by B C A Skrotzki
*Associate Editor*

| Company | Location | Plant Name | Consulting Engineers | First Operation, Year Units | Nominal Pressure, psi | Nominal Steam Temperature, F | BOILERS: Number | Capacity, Each lb per hr | Manufacturer | Waterwall Surface, sq ft | Heating Surface, sq ft | Furnace Volume, cu ft | Heat Release, Btu per cu ft per hr | Furnace Section | Economizer Surface per Boiler, sq ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1400 PSI AND ABOVE** | | | | | | | | | | | | | | | |
| Consolidated Edison Co of N Y | Manhattan, NYC, N.Y. | Waterside No. 1 | | 12-48 | 1600 | 950 | 1 | 1000 | CE | 14.2 | 16.1 | 68.5 | 17.0 | ST | 34.1 |
| | | | | 7-49 | 1600 | 950 | 1 | 1000 | CE | 14.2 | 16.1 | 68.5 | 17.0 | ST | 34.1 |
| | | | | ..... | 1801 | 500 | . | .... | .... | .... | .... | .... | .... | .... | .... |
| | | | | ..... | 1801 | 500 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Public Service Elec & Gas Co | Sewaren, N. J. | Sewaren | | 8-48 | 1500 | 1050 | 1 | 850 | CE | 8.9 | 3.0 | 51.7 | 19.9 | ST | 34.2 |
| | | | | 8-48 | 1500 | 1050 | 1 | 850 | CE | 8.9 | 3.0 | 51.7 | 19.9 | ST | 34.2 |
| | | | | 10-49 | 1500 | 1050 | 1 | 850 | CE | 8.9 | 3.0 | 51.7 | 19.9 | ST | 34.2 |
| Long Island Lighting Co | Port Jefferson, N. Y. | ..... | Ebasco Services | 6-48 | 1400 | 950 | 2 | 425 | CE | 8.6 | 7.0 | 29.2 | 17.9 | DB | 13.6 |
| **1000 TO 1399 PSI** | | | | | | | | | | | | | | | |
| Atlantic City Electric Co | Atlantic City, N. J. | Missouri Ave | Amer Gas & Elec Serv | 10-46 | 1385 | 1000 | 1 | 300 | FW | 3.8 | 4.0 | 16.1 | 22.6 | DB | 14.6 |
| Ohio Power Co | Brilliant, Ohio | Tidd | Amer Gas & Elec Serv | 6-48 | 1375 | 925 | 1 | 950 | BW | 13.8 | 0 | 66.5 | 17.1 | DB | 18.8 |
| The Cincinnati Gas & Elec Co | Cincinnati, Ohio | West End | | 7-48 | 1285 | 925 | 3 | 350 | BW | 11.4 | 0 | 12.3 | 35.7 | ST | 7.0 |
| Public Service Elec & Gas Co | Newark, N. J. | Essex | | 11-47 | 1250 | 1000 | 1 | 900 | BW | 10.3 | 11.1 | 47.8 | 22.3 | ST | 16.4 |
| New Jersey Power & Light Co | Milford, N. J. | Gilbert | Gilbert Associates | 1949 | 1250 | 950 | 1 | 650 | CE | .... | .... | 49.5 | 16.0 | DB | .... |
| Loup River Public Power Dist | Bellevue, Neb. | Bellevue | Sargent & Lundy | 1949 | 1250 | 950 | 3 | 200 | BW | .... | .... | .... | .... | DB | .... |
| Buffalo-Niagara Elec Corp | Buffalo, N. Y. | C R Huntley | | 12-48 | 1250 | 950 | 1 | 875 | BW | 18.4 | 0 | 38.3 | 25.8 | ST | 19.4 |
| Central New York Power Corp | Oswego, N. Y. | Oswego | | 12-48 | 1250 | 950 | 1 | 875 | BW | 9.8 | 7.6 | 43.5 | 23.1 | ST | 24.0 |
| New Orleans Public Service, Inc | New Orleans, La. | Industrial Canal | EbascoS ervices | 5-48 | 1250 | 950 | 1 | 400 | FW | 10.9 | 5.1 | 28.1 | 20.1[3] | .... | 16.9 |
| Rochester Gas & Elec Corp | Greece, N. Y. | Lakeside | Gilbert Assoc | 10-48 | 1250 | 950 | 1 | 400 | CE | .... | .... | .... | .... | .... | 11.6 |
| West Penn Power Co | Courtney, Pa. | Mitchell | Sanderson & Porter | 1-49 | 1250 | 925 | 2 | 500 | BW | 8.6 | 8.0 | 41.7 | 13.6 | DB | 21.5 |
| Commonwealth Edison Co | Chicago, Ill. | Fisk | Sargent & Lundy | 5-49 | 1250 | 925 | 2 | 750 | BW | 16.4 | 5.3 | 47.5 | 18.8 | ST | 14.1 |
| Boston Edison Co | Everett, Mass. | Mystic | Jackson & Moreland | 10-47 | 1200 | 910 | 1 | 430 | CE | 7.5 | 9.4 | 23.2 | 22.7 | DB | 12.3 |
| Gulf States Utilities Co | Lake Charles, La. | Riverside | Sanderson & Porter / Stone & Webster | 6-47 | 1050 | 825 | 1 | 420 | FW | 6.8 | 7.8 | 19.7 | 28.1 | .... | |
| **800 TO 999 PSI** | | | | | | | | | | | | | | | |
| Florida Power & Light Co | Riviera, Fla. | Riviera | Ebasco Services | 11-46 | 925 | 900 | 2 | 250 | BW | .... | .... | 11.7 | 27.2 | .... | .... |
| Consumers Power Co | Essexville, Mich. | John C Weadock | Commonw & South | 10-47 | 900 | 900 | 1 | 550 | FW | 10.6 | 11.6 | 36.6 | 20.3 | DB | 34.6 |
| | | | | 11-49 | 900 | 900 | 1 | 600 | FW | 10.6 | 11.6 | 36.6 | 22.4 | DB | 34.6 |
| | | | | 12-49 | 900 | 900 | 1 | 600 | FW | 10.6 | 11.6 | 36.6 | 22.4 | DB | 34.6 |
| Consumers Power Co | Muskegon, Mich. | B C Cobb | Commonw & South | 6-48 | 900 | 900 | 1 | 600 | CE | 11.1 | 7.3 | 41.1 | 19.0 | DB | 20.4 |
| | | | | 10-48 | 900 | 900 | 1 | 600 | CE | 11.1 | 7.3 | 41.1 | 19.0 | DB | 20.4 |
| | | | | 11-49 | 900 | 900 | 1 | 600 | CE | 11.1 | 7.3 | 41.1 | 19.0 | DB | 20.4 |
| Consumers Power Co | Comstock, Mich. | BryceE Morrow | Commonw & South | 6-49 | 900 | 900 | 1 | 600 | FW | 10.6 | 11.6 | 36.6 | 22.4 | DB | 34.6 |
| Central Illinois Pub Serv Co | Meredosia, Ill. | Meredosia | Sargent & Lundy | 11-47 | 900 | 900 | 4 | 285 | CE | 7.2 | 12.1 | 20.0 | 18.0 | DB | .... |
| Texas Electric Service Co | Handley, Tex. | Handley | Ebasco Services | 12-47 | 900 | 900 | 2 | 215 | BW | 2.5 | 13.0 | 9.5 | 31.5 | DB | 0 |
| Pennsylvania Electric Co | Warren, Pa. | Warren | Gilbert Associates | 4-48 | 875 | 885 | 2 | 185 | EC | 6.5 | 13.3 | 11.4 | 19.9 | DB | 0 |
| | | | | 4-49 | 875 | 885 | 2 | 185 | EC | 6.5 | 13.3 | 11.4 | 19.9 | DB | 0 |
| Gulf Power Co | Pensacola, Fla. | Pensacola | Commonw & South | 5-49 | 875 | 860 | 1 | 230 | RS | 7.9 | 11.7 | 13.4 | 22.3 | .... | 0 |
| Mississippi Power Co | Hattiesburg, Miss. | Eaton | E C Gaston | 6-47 | 875 | 860 | 1 | 230 | RS | 7.9 | 11.7 | 13.4 | 22.3 | .... | 0 |
| The Connecticut Light & Pwr Co | Devon, Conn. | Devon | | 4-47 | 850 | 925 | 2 | 225 | CE | 3.2 | 15.3 | 12.7 | 22.7 | DB | 0 |
| Philadelphia Electric Co | Philadelphia, Pa. | Southwark | | 4-47 | 850 | 900 | 2 | 850 | BW | 20.7 | .... | 40.5 | 25.3 | ST | 21.4 |
| Cons Gas, Elec Lt & Pwr Co Balt | Turner, Md. | Riverside | | 7-48 | 850 | 900 | 1 | 550 | BW | 6.2 | 7.4 | 29.0 | 23.4 | DB | 13.2 |
| The Detroit Edison Co | Marysville, Mich. | Marysville | | 2-47[20] | 850 | 900 | 1 | 440 | CE | 7.1 | 6.6 | 27.8 | 23.5 | DB | 12.1 |
| Houston Ltg & Power Co | near Houston, Tex. | West Junction | Ebasco Services | 6-47 | 850 | 900 | 1 | 400 | RS | 4.6 | 16.0 | 16.5 | 30.6 | .... | 2.9 |
| So California Edison Co | Redondo Beach, Calif. | Redondo | Stone & Webster | 2-48 | 850 | 900 | 2 | 400 | BW | 3.6 | 7.7 | 13.9 | 37.6 | .... | 5.8 |
| | | | | | 850 | 900 | 2 | 400 | BW | 3.6 | 7.7 | 13.9 | 37.6 | .... | 5.8 |
| Indianapolis Pwr & Lt Co | Indianapolis, Ind. | Harding St | Gibbs & Hill | 5-47 | 850 | 900 | 1 | 400 | CE | 7.0 | 18.9 | 23.2 | 22.8 | ST | 0 |
| Indianapolis Pwr & Lt Co | near Martinsville, Ind. | White River | Gibbs & Hill | 1-49 | 850 | 900 | 1 | 400 | CE | 7.0 | 18.9 | 23.2 | 22.8 | ST | 0 |
| The Potomac Edison Co | Williamsport, Md. | Williamsport | Sanderson & Porter | 11-48 | 850 | 900 | 1 | 350 | CE | 6.9 | 8.7 | 21.9 | 20.0 | DB | 13.8 |
| Central Arizona Lt & Pwr Co | Phoenix, Ariz. | Phoenix | Ebasco Services | 5-48 | 850 | 900 | 1 | 325 | BW | 3.5 | 19.3 | 16.1 | 25.9 | .... | 0 |
| The United Illuminating Co | New Haven, Conn. | English | Westcott & Mapes | 9-48 | 850 | 900 | 1 | 320 | BW | 5.6 | 0 | 22.7 | 16.9 | DB | 10.3 |
| San Diego Gas & Elec Co | San Diego, Calif. | Silver Gate | P U E & S Corp | 1-47 | 850 | 900 | 2 | 300 | BW | .... | .... | 12.0 | 31.9 | .... | 0 |
| Staten Island Edison Corp | Travis, N. Y. | Arthur Kill | Gilbert Assoc | 7-47 | 850 | 900 | 2 | 120 | FW | 5.6 | 7.3 | 8.1 | 19.2 | DB | 0 |
| Central Power & Light Co | Corpus Christi, Tex. | Nueces Bay | Sargent & Lundy | 11-49 | 850 | 900 | 1 | 300 | BW | .... | .... | .... | .... | .... | .... |
| Florida Power Corp | Enterprise, Fla. | Benson Springs | J G White Eng Corp | 11-47 | 850 | 900 | 1 | 300 | BW | 20.9 | .... | 21.9 | 17.0 | .... | 0 |
| Florida Power Corp | Inglis, Fla. | Inglis | J G White Eng Corp | 4-47 | 850 | 900 | 1 | 300 | BW | 20.9 | .... | 21.9 | 17.0 | .... | 0 |
| Southwestern Gas & Elec Co | Mooringsport, La. | Lieberman | Sargent & Lundy | 6-47 | 850 | 900 | 1 | 250 | BW | 3.2 | 15.7 | 13.2 | 24.5 | .... | 0 |
| Iowa-Illinois Gas & Elec Co | Davenport, Ia. | Riverside | United Lt & Rwys | 5-49 | 850 | 900 | 2 | 250 | RS | 10.5 | 14.5 | 17.5 | 19.8 | DB | 0 |
| N Y State Elec & Gas Corp | Corning, N. Y. | | Gilbert Associates | 11-48 | 850 | 900 | 2 | 175 | CE | 2.5 | 14.4 | 9.6 | 20.7 | .... | 7.7 |
| Interstate Power Co | Lansing, Ia. | Lansing | Sargent & Lundy | 1-48 | 850 | 900 | 2 | 120 | RS | 6.0 | 7.3 | 8.9 | 17.4 | DB | 0 |
| Pub Serv Co of Colorado | Denver, Col. | Lacombe | Electric Advisers | 7-47 | 850 | 885 | 1 | 350 | BW | 5.4 | 16.5 | 17.7 | 26.6 | ST | 0 |
| | | | | 11-47 | 850 | 825 | 1 | 150 | BW | .... | 10.6 | 5.1 | 42.3 | .... | 0 |
| South Carolina Power Co | Charleston, S. C. | Hagood | Commonw & South | 10-47 | 850 | 850 | 1 | 230 | RS | 7.9 | 11.7 | .... | 21.4 | .... | 0 |
| Ohio Public Service Co | Lorain, Ohio | Edgewater | Electric Advisers | 10-48 | 825 | 900 | 2 | 350 | BW | 6.6 | 3.0 | 32.1 | 13.4 | DB | 0 |
| **600 TO 799 PSI** | | | | | | | | | | | | | | | |
| Kansas City Pwr & Lt Co | Kansas City, Mo. | Grand Ave | United Lt & Rwys | 8-48 | 750 | 950 | 1 | 375 | CE | .... | .... | 21.0 | 23.1 | ST | 70 |
| Pennsylvania Electric Co | Indiana County, Pa. | Seward | Gilbert Associates | 6-48 | 675 | 825 | 1 | 300 | BW | 4.2 | 24.2 | 17.8 | 21.0 | DB | 0 |
| Sioux City Gas & Elec Co | Sioux City, Ia. | Kirk | | 1-47 | 675 | 725 | 1 | 75 | FW | 1.5 | 7.9 | 3.3 | .... | .... | 4.8 |
| Potomac Electric Power Co | Benning, D. C. | Benning | Stone & Webster | ..... | 670 | 900 | 1 | .... | BW | 6.1 | 8.7 | 30.7 | 21.6 | DB | 15.3 |
| Southern Colorado Pwr Co | Pueblo, Colo. | Pueblo | P U E & S Corp | 1949 | 650 | 900 | 1 | 185 | BW | .... | .... | 14.5 | 19.5 | DB | 0 |
| Wisconsin Pub Serv Corp | Green Bay, Wis. | Bayside | P U E & S Corp | 1947 | 650 | 900 | 1 | 312 | BW | 5.6 | 2.7 | .... | 20.0 | DB | 6.8 |
| Central Power & Light Co | San Benito, Tex. | La Palma | Sargent & Lundy | 7-47 | 650 | 835 | 1 | 250 | BW | .... | .... | .... | 28.8 | .... | 0 |
| | | | | 11-48 | 650 | 835 | 1 | 250 | BW | .... | .... | .... | 28.8 | .... | 0 |
| Dallas Power & Light Co | Dallas, Tex. | Mountain Creek | Ebasco Serv | 1949 | 650 | 825 | 1 | 330 | BW | .... | .... | 11.6 | 36.0 | .... | 2.5 |
| Eastern Shore Pub Serv Co of Md | Vienna, Md. | Vienna | United Eng & Const | 1950 | 650 | 825 | 1 | 160 | BW | 2.7 | 12.6 | 9.6 | 21.3 | DB | 0 |
| The United Illuminating Co | Bridgeport, Md. | Steel Point | Westcott & Mapes | 7-46[16] | 625 | 850 | 2 | 150 | BW | 2.6 | 9.5 | 8.3 | 22.1 | DB | 0 |
| West Texas Utilities Co | Abilene, Tex. | Abilene | Sargent & Lundy | 6-48 | 625 | 845 | 1 | 100 | BW | 1.5 | 6.8 | 4.3 | 31.0 | .... | 0 |
| Imperial Irrigation District | El Centro, Calif. | El Centro | Gibbs & Hill | 1948 | 625 | 825 | 1 | 260 | CE | 1.8 | 15.2 | .... | 33.3 | .... | 0 |
| Central Louisiana Elec Co | St. Landry, La. | Coughlin | Sargent & Lundy | 1948 | 600 | 825 | 2 | 90 | BW | .... | .... | .... | .... | .... | .... |
| Northwestern Pub Serv Co | Mitchell, S. D. | Mitchell | Sargent & Lundy | 6-48 | 600 | 825 | 2 | 50 | CE | 1.1 | 6.8 | 2.5 | 26.5 | .... | 1.1 |
| **400 TO 599 PSI** | | | | | | | | | | | | | | | |
| Omaha Public Power Dist | South Omaha, Neb. | South Omaha | | 10-47 | 475 | 760 | 1 | 200 | CE | 2.7 | 11.8 | 6.9 | 38.0 | .... | 0 |
| Mt. Carmel Pub Utility Co | Mt. Carmel, Ill. | Mt. Carmel | | 7-47 | 450 | 750 | 1 | 60 | Vo | .... | .... | .... | .... | .... | 0 |
| Sheridan County Electric Co | Sheridan, Wyo. | Acme | | 11-47 | 450 | 750 | 1 | 45 | BW | .... | .... | .... | .... | .... | .... |
| Peoples Gas & Electric Co | Mason City, Ia. | Mason City | | 1948 | 450 | 935 | 1 | 100 | BW | .... | .... | .... | .... | .... | .... |
| Florida Power & Light Co | Lake Monroe, Fla. | Sanford | Ebasco Serv | 12-47 | 425 | 750 | 1 | 125 | CE | 1.7 | 10.7 | 5.8 | 27.3 | .... | 0 |
| Missouri Utilities Co | Poplar Bluff, Mo. | Poplar Bluff | Black & Veatch | 10-46 | 400 | 750 | 1 | 75 | BW | 1.5 | 6.2 | 4.3 | 23.0 | DB | 0 |

A —Air cooled
AAlu —Arsenical Aluminum brass
AAd —Arsenical Admiralty
Abr —Aluminum bronze
Alu —Aluminum brass
AC —Allis-Chalmers Mfg Co
As —Arsenical copper
Ad —Admiralty
BW —Babcock & Wilcox Co
C —Coal, bituminous
CA —Coal, anthracite
CB —Combustion Engineering Co
CG —Chain grate
Cr —Crushed coal, cyclone burner
Cu —Copper
Dm —Dual drive
Du —Dumper
DB —Dry bottom
DT —Dowtherm system
Du —Duplex drive
EC —Erie City Iron Works
Ell —Elliott Co
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
H —Hydrogen cooled
Hy —Hydraulic coupling
IAd —Inhibited Admiralty metal
L —Lignite
Lo —Louvers
M —Motor drive
Mo —Magnetic coupling
MP —Metal Power Units, Ltd
MB —Murray Iron Works
MS —Moore Steam Turbine Div
Mu —Munts metal
O —Oil
P —Pulverized-fuel firing
PAd —Phosphorized admiralty
Pl —Plate
QMp —Two motors per fan
sion, Worthington Pump & Machinery Co

# Planned Since September 1946

| Economizer Surface, per Boiler, 1000 sq ft | Air-Heater Surface, per Boiler 1000 sq ft | Air-Heater Type | F-D FANS: Drive | F-D FANS: Air-Volume Control | I-D FANS: Drive | I-D FANS: Gas-Volume Control | FUEL: Firing | FUEL: Type | FUEL: Heating Value, 1000 Btu per lb | FUEL: Air-Preheat Temperature, F | FEED PUMPS: Drive | FEED PUMPS: Flow Control | TURBINES: Capacity, 1000 kw | TURBINES: Speed, rpm | TURBINES: Manufacturer | TURBINES: Inlet-Steam Pressure, psia | TURBINES: No. of Bleed Points | TURBINES: Generator Cooling | CONDENSERS: Surface, 1000 sq ft | CONDENSERS: No. Water Passes | CONDENSERS: Tube Material | Total Boiler Capacity (at) New Units, 1000 lb | Total Generator Capacity (at) New Units, 1000 kw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34.1 | 260 | Re | M | V | M | V | P | C | 11.9 to 14.4 | 2450 2900 | 3T | S | 50 50 | 3600 3600 | WE WE | 215 215 | 1 1 | H H | .... .... | .. .. | .... .... | 5460 6460 | ..... ..... |
| .... | ..... | ... | .... | ..... | .... | ..... | ..... | ..... | .... | .... | ..... | ... | 60 | 1800 | GE | 0.75 | 12 | H | 74.5 | 2 | Abr | .... | 598 |
| .... | ..... | ... | .... | ..... | .... | ..... | ..... | ..... | .... | .... | ..... | ... | 60 | 1800 | GE | 0.75 | 12 | H | 74.5 | 2 | Abr | .... | 658 |
| 34.2 | 260 | Re | M | Hy | M | Lv | P | C, O | 13.9 | 2100 | 3M | Hy | 100 | 3600 | WE | 0.75 | 8 | H | 50 | 1 | .... | 850 | 100 |
| 34.2 | 260 | Re | M | Hy | M | Lv | P | C, O | 13.9 | to | 3M | Hy | 100 | 3600 | GE | 0.75 | 8 | H | 60 | 1 | .... | 1700 | 200 |
| 34.2 | 260 | Re | M | Hy | M | Lv | P | C, O | 13.9 | 2600 | 3M | Hy | 100 | 3600 | GE | 0.75 | 8 | H | 60 | 1 | .... | 2550 | 300 |
| 13.6 | 96.0 | Re | M | Da | M | Da | P | C, O | 13.5 | 2200 | 2M | R | 44 | 3600 | GE | 1.25 | 5 | H | 37.5 | 2 | Abs | 850 | 88 |
| 14.6 | 58.2 | Re | M | V | M | V | P | C | 12.5 | 2300 | 2M | ... | 25 | 3600 | GE | 0.5 | 4 | H | 23.3 | 1 | Abs | 995 | 97 |
| 18.8 | 140.1 | Re | M | V | M | V | P | C | 11.3 | 2400 | 3M | .... | 100 | 1800 | GE | 0.5 | 5 | H | 58.0 | 1 | Ac | 1900 | 200 |
| 7.0 | 53.1 | Tu | M | V | M | Da | P | C | 13.9 | 2480 | 3T | S | 35 | 3600 | WE | 275 | .. | H | ..... | .. | ..... | 1950 | 214 |
| 16.4 | 260 | Re | M | Hy | M | Lv | P | C, O | 13.9 | 2100[3] | 3M | Hy | 100 | 3600 | GE | 0.75 | 8 | H | 55.0 | 2 | Abs | ... | 320 |
| .... | ..... | Re | M | V | M | Ma | P | C | 13.0 | 2000 | 2M, 1Du | R | 60 | 3600 | GE | 0.5 | 5 | H | 50.0 | 2 | Ad | 1150 | 115 |
| .... | ..... | ... | M | V | M | V | P | C | 11.0 | .... | 2M, 1T | Hy | 30 | 3600 | GE | ..... | 5 | H | .... | .. | .... | 600 | 60 |
| 19.4 | 164 | Tu | M | V | M | Ma | P | C | 13.0 | 2200 | 3M | S | 80 | 3600 | WE | 0.5 | 6 | H | 55.0 | 1 | Ad | 8575 | 625 |
| 24.0 | 159 | Tu | M | V | M | Ma | P | C | 13.0 | 2200 | 3M | Hy | 80 | 1800 | GE | 0.5 | 6 | H | 55.0 | 1 | Ad | 2675 | 240 |
| 16.9 | 85.0 | Re | M | V | M | V | O, G[5] | O, G | .... | .... | 3M | R | 37.5 | 3600 | GE | 1.25 | 4 | H | 30.0 | 2 | .... | 800 | 75 |
| .... | ..... | ... | .... | ..... | .... | ..... | P | C | ..... | ..... | ..... | .... | 40 | 3600 | GE | 0.5 | 5 | ... | ..... | .. | .... | 400 | 40 |
| 11.6 | 67.4 | Tu | M | V | M | S | P | C | 13.0 | 2200 | 3M | .... | 65 | 3600 | WE | 0.75 | 4 | H | 50.0 | 1 | Su | 1000 | 65 |
| 21.5 | 105.5 | Tu | M | V | M | V | Cr | C | 10.0 | 2350 | 3M, 1T | R | 150 | 1800 | GE | 0.5 | 4 | H | 90.0 | 1 | AAd | .... | 473 |
| 14.1 | 61.0 | Re | M | V | M | V | P | C | 13.5 | 2550 | 2M | .... | 40 | 3600 | GE | 0.5 | 4 | H | 33.8 | 1 | Abs | 1290 | 120 |
| 12.3 | 46.8 | Re | M | V | M | V | G | G | 956[6] | .... | 2M, 1T | .... | 35 | 3600 | AC | 1.0 | 4 | H | 35.0 | 2 | Ad | 420 | 35 |
| .... | 35.1 | Re | M | V | M | V | O | O | 18.3 | .... | 2M, 1T | S | 43.75 | 3600 | WE | 1.75 | 5 | H | 34.5 | 1 | Abr | 500 | 43.75 |
| 34.6 | 60.1 | Tu | M | V | M | S, Hy | P | C | 12.5 | 2300 | 1M | .... | 50 | 3600 | GE | 0.5 | 4 | H | 43.0 | 2 | Ad | 1900 | 170 |
| 34.6 | 60.1 | Tu | M | V | M | S, Hy | P | C | 12.5 | to | 1M | .... | 60 | 3600 | GE | 0.75 | 4 | H | 45.0 | 2 | Ad | 2500 | 230 |
| 34.6 | 60.1 | Tu | M | V | M | S, Hy | P | C | 12.5 | 2500 | 1M | .... | 60 | 3600 | GE | 0.75 | 4 | H | 45.0 | 2 | Ad | 3100 | 290 |
| 20.4 | 111.0 | Pl | M | S, Hy | M | S, Hy | P | C | 12.5 | 2300 | | | 60 | 3600 | WE | 0.75 | 4 | H | 42.5 | 2 | Ad | 600 | 60 |
| 20.4 | 111.0 | Pl | M | S, Hy | M | S, Hy | P | C | 12.5 | to | 4M | .... | 60 | 3600 | WE | 0.75 | 4 | H | 42.5 | 2 | Ad | 1200 | 120 |
| 20.4 | 111.0 | Pl | M | S, Hy | M | S, Hy | P | C | 12.5 | 2500 | | | 60 | 3600 | WE | 0.75 | 4 | H | 45.0 | 2 | Ad | 1800 | 180 |
| 34.6 | 60.1 | Tu | M | V | M | S, Hy | P | C | 12.5 | .... | 1M | .... | 60 | 3600 | WE | 0.75 | 4 | H | 45.0 | 2 | Ad | 1950 | 180 |
| .... | 51.4 | Tu | M | S, Ma | M | S, Ma | P | C | 9.9 | 1900 | 3M, 1T | R | 50[7] | 3600 | GE | 1.0 | 4 | H | 45.0 | 1 | Cu | 1114 | 100 |
| 0 | 226 | Re | M | V | M | Da | G | G | 0.97[11] | .... | 1M 1T | R | 43.75 | 3600 | WE | 1.12 | 4 | H | 41.3 | 2 | Ac | 430 | 43.75 |
| 0 | 28.0 | Tu | M | V | 2Mp | V | P | C | 13.0 | .... | ..... | R | 30 | 3600 | WE | 0.5 | 5 | H | 32.5 | 2 | Ad | 370 | 30 |
| 0 | 28.0 | Tu | M | V | 2Mp | V | P | C | 13.0 | .... | ..... | R | 30 | 3600 | WE | 0.5 | 5 | H | 32.5 | 2 | Ad | 740 | 60 |
| 0 | 31.5 | Tu | 2Mp | V | 2Mp | V | G, O | G | 1000[6] | .... | 2M | R | 22.5 | 3600 | GE | 1.0 | 3 | H | 20.4 | 2 | Abs | 460 | 45 |
| 0 | 31.5 | Tu | 2Mp | V | 2Mp | Da | G, O | G | 1000[6] | .... | 2M | R | 25 | 3600 | GE | 1.0 | 3 | H | 20.4 | 2 | Abs | 460 | 50 |
| 0 | 40.8 | Re | M | V | M | Hy | P | C | 14.0 | 2400 | 2M | R | 45 | 3600 | WE | 0.5 | 5 | H | 30.0 | 1 | Abs | 2000 | 165 |
| 21.4 | 123.0 | Re | M | Hy | M | Hy | P | C | 14.0 | 2600 | 3M | R | 150 | Comp[8] | WE | 0.5 | 4 | H | 79.0 | 1 | Ad | 1700 | 150 |
| 13.2 | 66.6 | Re | M | V | M | S, V | P | C | 13.0 | 2400 | 2M | S | 60 | 3600 | GE | 0.5 | 4 | H | 46.5 | 2 | AAbs | 1650 | 180 |
| 12.1 | 83.6 | Re | M | S | M | S | P | C | 13.2 | 2100 | 2M | S | 75 | 1800 | GE | 0.5 | 4 | A | 47.8 | 1 | Ad | 1760 | 300 |
| 2.9 | 66.0 | Tu | M | V | M | V | G | G | 1040[6] | .... | 1M | .... | 37.5 | 3600 | GE | 1.25 | 3 | H | 36.0 | 2 | Ac | 600 | 75 |
| 5.8 | 62.4 | Re | M | Da, V | M | Da, V | O | O | 18.5 | .... | 6M, 1T | R | 60 | 3000 | GE | 0.75 | 4 | H | 42.5 | 2 | Abr | 800 | 60 |
| 5.8 | 62.4 | Re | M | Da, V | M | Da, V | O | O | 18.5 | .... | | R | 60 | 3000 | WE | 0.75 | 4 | H | 42.5 | 2 | Abr | 1600 | 120 |
| 0 | 51.4 | Re | M | V | 2Mp | Da | P | C | 10.8 | 1970 | 2M, 1Du | R | 37.5 | 3600 | GE | 0.75 | 4 | H | 30.0 | 2 | AAd | 1792 | 148 |
| 0 | ..... | Re | 2Mp | V | 2Mp | V | P | C | 10.8 | 1970 | 2M, 1Du | R | 40 | 3600 | GE | 0.75 | 5 | H | 30.0 | 2 | AAd | 400 | 40 |
| 13.8 | 45.2 | Tu | M | V | M | V | P | C | 12.0 | 2400 | 2M | R | 30 | 3600 | GE | 0.75 | 4 | H | 27.5 | 2 | .... | 1170 | 80 |
| 0 | 56.1 | Tu | M | V | M | Da, V | O, G | G | 1050[6] | .... | 1M, 1T | R | 30 | 3600 | GE | 1.25 | 4 | H | 25.0 | 2 | Ac | 940 | 73 |
| 10.3 | 82.6 | Re | 2Mp | V | 2Mp | V | P | C | 13.7 | 2300 | 2M, 1T | R | 30 | 3600 | GE | 0.75 | 5 | H | 27.5 | 1 | Abs | 1388 | 105 |
| 0 | 44.7 | Tu | M | Da, V | M | Da | O | O, G | 18.2[9] | .... | 3M | R | 60 | 3600 | GE | 0.75 | 4 | H | 40.7 | 2 | Abs | 1000 | 85 |
| 0 | 24.6 | Tu | M | V | 2Mp | V | P | C, O | 14.2 | 2470 | 1M, 1Du | R | 25 | 3600 | WE | 0.5 | 4 | H | 18.9 | 2 | Abs | 240 | 25 |
| .... | ..... | Tu | M | ..... | M | V | G, O | G | 1030[6] | .... | 1M, 1T | R | 30 | 3600 | WE | 0.75 | 4 | H | .... | .. | Abs | 820 | 75 |
| 0 | 49.8 | Tu | 2M | Da | 2M | Da | O | O | 18,000 | .... | 3M | R | 25 | 3600 | WE | 1 | 4 | H | 25 | 1 | Ac | 500 | 37.5 |
| 0 | 49.8 | Tu | 2M | Da | 2M | Da | O | O | 18,000 | .... | 3M | R | 25 | 3600 | GE | 1 | 4 | H | 23 | 1 | Abs | 750 | 50 |
| 0 | 38.6 | Tu | M | V | M | V | G, O | G | 1000[6] | .... | 1M, 1T | R | 25 | 3600 | GE | 0.75 | 4 | H | 18.5 | 1 | .... | 250 | 25 |
| 0 | 68.1 | Re | M | V | M | Hy | P | C | 10.0 | 2100 | 1M, 1T | .... | 40 | 3600 | GE | 0.75 | 4 | H | 37.5 | 2 | .... | 1520 | 105 |
| 7.7 | 12.0 | Tu | M | V | M | Ma | TG(672) | CA | 11.6 | 2900 | 1M, 1T, 1Du | R | 30 | 3600 | WE | 0.75 | 4 | H | 27.5 | 2 | Ad | 350 | 30 |
| 0 | 20.8 | Tu | M | V | M | Hy | P | C | 10.4 | 1900 | 1M, 1T | .... | 15 | 3600 | AC | 0.5 | 4 | H | 15.0 | 2 | PAd | 240 | 15 |
| 0 | 63.3 | Tu | 2Mp | S, V | M | V | P | L, O, G | 9.3 | 2150 | 2T, 1Du | R | 35 | 3600 | GE | 0.75 | 6 | H | 25.0 | 2 | PAd | 610 | 47.5 |
| 0 | 15.2 | Tu | M | V | M | V | O | O | 19,600 | .... | ..... | ... | ... | 3600 | ... | ... | 3 | ... | ... | .. | .... | .... | ..... |
| 0 | 31.8 | Tu | 2Mp | S, D | 2Mp | S, Da | O | O | 18,300 | .... | 2M, | R | 25 | 3600 | GE | 1.5 | 3 | H | 20.4 | 2 | Abs | 230 | 25 |
| 0 | 74.1 | Tu | 2Mp | V | 2Mp | V | P | C | 12,400 | 1900 | 2T 2Du | R | 60 | 3600 | WE | 0.5 | 6 | H | 45.0 | 2 | .... | 700 | 90 |
| 10 | 115.0 | Re | M | V | M | Hy | P, G | C | 10.3[10] | 2000 | 1M | .... | 35 | 3600 | WE | 0.75 | 6 | H | 32.5 | 1 | IAd | 1800 | 141 |
| 0 | 42.6 | Tu | M | V | 2Mp | V | P | C | 12.1 | 2400 | ..... | .... | ... | ... | ... | ... | ... | ... | ... | ... | .... | 1250 | ..... |
| 4.8 | 3.6 | Tu | M | V | M | S, Da | SS(166) | C, G | 11.8[11] | 2070 | 1M | .... | 7.5 | 3600 | WE | 1 | 3 | A | 7.6 | 2 | PAd | 305 | 16.4 |
| 15.3 | 125.8 | Re | M | V | M | Ma | P | C | 12.5[12] | 2100[13] | 2M, 1T | S | 50 | 1800 | GE | .... | 4 | A | 47.5 | 2 | Ad | 2600 | 235 |
| 0 | 34.9 | Re | M | V | M | V | G, P[14] | G | 875[6] | .... | 3M | R | 15 | 3600 | GE | 0.75 | 3 | H | 16 | 2 | Ad | .... | 35 |
| 6.8 | ..... | Re | M | Ma | M, T | Ma | P | C | 11.9 | 2600 | 2M, 1T | R | 30 | 3600 | WE | 0.75 | 4 | H | 15.9 | 1 | Ad | 885 | 80 |
| 0 | 36.3 | Tu | M | V | M | V | G | G | 1.03[6] | .... | 1M, 1T | R | 20 | 3600 | GE | 0.75 | 4 | H | 22.5 | 2 | Ad | 760 | 61 |
| 0 | 36.3 | Tu | M | V | M | V | G | G | 1.03[6] | .... | 1M, 1T | R | 20 | 3600 | GE | 0.75 | 4 | H | 22.5 | 2 | Ad | 1010 | 81 |
| 2.5 | 59.5 | Re | M | V | M | V | G, O[15] | G | 1.0[6] | .... | 2M, 1T | R | 25 | 3600 | GE | 1.75 | 3 | H | 27.1 | 1 | Ae | 1030 | 81 |
| 0 | 53.9 | Re | M | V | 2Mp | S | P | C | 14.0 | 2595 | 3M | R | 15 | 3600 | WE | 1.5 | 5 | A | 14.0 | 2 | Ad | 720 | 57 |
| 0 | 14.2 | Tu | M | V | M | V | P, O | C | 14.2 | 2575 | 2M, 1T | R | 6 | 3600 | GE | 230 | 0 | A | .... | .. | .... | 1465 | 116 |
| 0 | 10.3 | Tu | M | V | M | Da | G, O | G | 1.13[6] | .... | 1M, 1T | R | 7.5 | 3600 | Ell | 1.0 | 3 | A | 8.0 | 2 | IAd | 280 | 12.5 |
| 0 | 31.9 | Re | 2Mp | V | 2Mp | Da | O | O | 18.5 | .... | 2M, 1T | .... | 20 2 | 3600 3600 | WE WE | 1.0 | 3 | H | 20.0 | 2 | .... | 260 | 22 |
| .... | ..... | ... | M | ..... | M | ..... | G | G | 1.05[6] | .... | 2M, 1T | R | 7.5[17] | 3600 | GE | 0.75 | 3 | A | 8.0 | 2 | Ad | 180 | 15 |
| 1.1 | 3.0 | Tu | M | V | M | V | TG(1700) | C | 10.25 | 2320 | 1M, 1T | .... | 7.5 | 3600 | AC | 0.5 | 3 | A | 7.5 | 2 | .... | 235 | 16 |
| 0 | 23.1 | Re | M | Da | M | Da | G, O[15] | G | .... | .... | 1M | R | 15 | 3600 | GE | 1.0 | 2 | H | 14.0 | 2 | Ae | 600 | 20 |
| 0 | 0 | ... | M | Da | M | Da | TG | C | 11.2 | .... | 1M, 1T | R | 4 | 3600 | AC | 1.0 | 3 | A | 7.0 | 2 | .... | 140 | 8 |
| .... | ..... | ... | M | ..... | M | ..... | SS | C | 9.0 | .... | 1M, 1T | S, R | 3 | 3600 | WE | .... | 3 | A | 3.5 | 2 | Ad | .... | 7 |
| .... | ..... | ... | .... | ..... | .... | ..... | P | C | 11.5 | 2100 | 2M, 1T | .... | 7.5 | 3600 | AC | .... | .. | .. | 10.5 | 2 | .... | 365 | 28 |
| 0 | 11.0 | Tu | M | V | M | Da | O | O | 18.3 | .... | 3M, 1T | S | 18.75 | 3600 | WE | 1.75 | 3 | H | 15.0 | 1 | Ad | .... | 28.8 |
| 0 | 8.5 | Tu | M | S, Da | 2Mp | S, Da | P | C | 12.0 | 2230 | 1M, 1T | .... | 5 | 3600 | WE | 1.25 | 3 | A | 6.0 | 2 | .... | 138 | 7.3 |

Public Quarry Engineering and Service Corp
—Regulator
—Regenerative
—Riley Stoker Corp
—Speed control
—Spreader stoker
—Slag tap
—Superloy
—Turbine drive
—Traveling-grate stoker
To —Tandem
UF —Underfeed stoker
V —Vane control
Wo —Henry Wort Machine Co
WB —William Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
(100) —Stoker grate area, sq ft
1—New 6-p turbines taking exhaust from topping turbines
Sixteen pres... ...ed and one ... ...ductions point, 17 pais
5—2100 to 2600 F
6—Gas fired
7—Provisions for future pulverized coal
8—Btu per cu ft
9—Two units
10—Cross compound; h-p 3600; l-p 1800
11—Gas 1070 Btu per cu ft
12—Gas 940 Btu per cu ft
13—... 1000 psi per sq in
14—12,500 to 14,500 Btu per lb
15—2100 to 2600 F
16—Pulverized coal standby
17—Oil standby
18—Boilers installed 12-45
19—Two units, 7,500 kw each
20—Continuous ash discharge
21—Oil and gas standby
22—Boiler ready June 1947

# Typical Industrials 200 Psi and Above Installed

Compiled by J C McCabe
*Assistant Editor*

| Company | Location | Consulting Engineers | First Operation, Year Units | Nominal Pressure, psi | Nominal Steam Temperature, F | BOILERS: Number | Capacity, Each, Lb per hr | Manufacturer | Waterwall Surface, Sq ft | Heating Surface, Sq ft | Furnace Volume, Cu ft | Heat Release, Btu per cu ft per hr | Fuel | Fuel Burned per Hour, Tons or Gal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **700 PSI AND ABOVE** | | | | | | | | | | | | | | |
| Dow Chemical Co | Midland, Mich | | 3-48 | 1250 | 900 | 1 | 400 | BW | 6.5 | 3.5 | 24.9 | 74.7[1] | ST | 17.4 |
| Wyandotte Chemical Corp | Wyandotte, Mich | | 1947 | 925 | 870 | 1 | 275 | BW | ... | .... | .... | .... | .... | .... |
| Scott Paper Co | Chester, Penna | Stone & Webster | 10-47 | 900 | 825 | 1 | 150 | CE | 3.1 | 14.3 | 9.7 | 18.9 | DB | .... |
| Solvay Process Co | Syracuse, N. Y. | | .... | 900 | 750 | 2 | 200 | BW | ... | .... | .... | .... | .... | .... |
| Standard Oil Co of Calif | Richmond, Calif | | 9-47 | 890 | 750 | 1 | 165 | RS | 2.5 | 13.4 | 8.9 | 24.8 | DB | .... |
| Eastman Kodak Co | Rochester, N. Y. | | 12-47 | 825 | 825 | 2 | 200 | BW | 2.4 | 16.9 | 9.4 | 28.2 | .... | 3.4 |
| Emery Industries, Inc | St. Bernard, Ohio | | 4-47 | 800 | Sat | 1 | 17 | BW | 1.9 | .... | .... | .... | DB | .... |
| **500 TO 699 PSI** | | | | | | | | | | | | | | |
| Scovill Mfg Co | Waterbury, Conn | Stone & Webster | ..... | 660 | 750 | 1 | 150 | RS | 5.0 | 8.9 | 7.6 | 23.0 | DB | .... |
| Atlantic Refining Co | Philadelphia, Pa | | 12-46 | 650 | 750 | 2 | 125 | BW | 2.1 | 11.7 | 7.0 | 24.6 | .... | .... |
| Celanese Corp of America | Newark, N. J. | | .... | 650 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| General Foods Corp | Battle Creek, Mich | | 1-48 | 650 | 750 | 1 | 125 | BW | 2.2 | 10.1 | 6.7 | .... | DB | 1.2 |
| Hummel & Downing Co | Milwaukee, Wisc | Sargent & Lundy | 1947 | 650 | 725 | 1 | 75 | BW | 2.5 | 8.1 | 4.7 | 21.6 | DB | .... |
| Monsanto Chemical Co | St Louis, Mo | | 12-47 | 650 | 750 | 1 | 200 | FW | 4.3 | 17.9 | 10.5 | 24.3 | DB | 9.6 |
| Shell Oil Co | Wood River, Ill | Ebasco Serv | 10-47 | 650 | 750 | 1 | 175 | BW | ... | 20.0[7] | ... | 15.8 | DB | 0 |
| General Aniline & Film Corp | Rensselaer, N. Y. | Baker & Spencer | 1948 | 625 | 755 | 2 | 115 | CE | 2.6 | 10.6 | 6.1 | 22.2 | DB | 0 |
| United States Sugar Corp | Clewiston, Fla | | .... | 620 | 650 | 1 | 100 | BW | 2.0 | 8.9 | 3.8 | .... | DB | .... |
| Alan Wood Steel Co | Conshohocken, Pa | H M Wilson | 1948 | 610 | 710 | 2 | 125 | RS | 3.1 | 18.5 | 10.0 | 20.0 | DB | .... |
| Carbide and Carbon Chem | Texas City, Tex | Ford, Bacon & Davis | .... | 600 | 700 | 4 | 156 | BW | ... | 12.0 | 5.4 | 40.0 | DB | .... |
| Celanese Corp of Amer | Narrows, Va | | 12-47 | 600 | 750 | 1 | 200 | RS | 7.2 | 14.7 | 13.0 | 20.0 | DB | .... |
| | | | 4-47 | 600 | 750 | 1 | 200 | RS | 7.2 | 14.7 | 13.0 | 20.0 | DB | .... |
| Celanese Corp of Amer | Rock Hill, S. C. | | 7-48 | 600 | 750 | 3 | 150 | RS | 5.5 | 11.1 | 8.8 | 23.2 | DB | .... |
| Chillicothe Paper Co | Chillicothe, Ohio | W I Barrows | 11-47 | 600 | 750 | 1 | 80 | RS | 1.7 | 9.3 | 4.0 | 29.0 | DB | 2.5 |
| El Paso Natural Gas | Eunice, N. M. | | 8-47 | 600 | 600 | 3 | 35 | BW | ... | 5.9 | .... | .... | .... | 0 |
| Hoberg Paper Mills, Inc | Green Bay, Wisc | Helmick, Edeskuty & Lutz | 4-48 | 600 | 750 | 2 | 60 | BW | 1.2 | 2.8 | .... | 16.9 | .... | 3.7 |
| Wood Conversion Co | Cloquet, Minn | Pfeiffer & Schultz | 8-47 | 600 | 825 | 1 | 90 | BW | .... | .... | .... | .... | DB | 0 |
| **400 TO 499 PSI** | | | | | | | | | | | | | | |
| Sun Oil Co | Marcus Hook, Pa | | 11-46 | 460 | 512 | 1 | 105 | BW | 1.6 | 9.2 | 4.4 | 28.2 | .... | .... |
| | | | 1947 | 460 | 512 | 1 | 105 | BW | 1.6 | 9.2 | 4.4 | 28.2 | .... | .... |
| American Optical Co | Southbridge, Mass | | 11-47 | 450 | 750 | 1 | 125 | CE | 1.2 | 10.6 | 4.9 | 32.5 | .... | 6.0 |
| Davey Company | Jersey City, N. J. | F L Smith | 8-47 | 450 | 600 | 1 | 36 | BW | ... | 4.9[7] | 1.3 | 30.0 | .... | 0 |
| Federal Paper Board Co | Steubenville, Ohio | W Wyburn | 1947 | 450 | 600 | 1 | 70 | UI | 1.2 | 8.7 | 2.7 | .... | .... | .... |
| Minnesota & Ontario Paper | International Falls, Minn | | 6-47 | 450 | 600 | 1 | 150 | CE | 2.3 | 14.9 | 8.2 | 23.7 | .... | 0 |
| Nekoosa Edwards Paper Co | Nekoosa, Wisc | | 9-47 | 450 | 700 | 1 | 110 | CE | 3.1 | 9.1 | 9.0 | 17.5 | DB | 0 |
| Parker Browne Co | Fort Worth, Tex | G D Elkins | 6-47 | 450 | 560 | 1 | 20 | Vo | ... | .... | .... | .... | .... | .... |
| Regal Laundry, Inc | Baltimore, Md | Day & Zimmerman | 6-47 | 450 | 550 | 1 | 35 | BW | ... | 3.9 | .... | .... | DB | 0 |
| Spaulding Fibre Co | No. Rochester, N. H. | F L Smith | 10-46 | 450 | .... | 1 | 30 | BW | 0.9 | 4.4 | .... | 30.0 | DB | 0 |
| St. Joseph Lead Co | Josephtown, Penna | | 7-47 | 450 | 700 | 2 | 6.5 | BW | ... | 3.9 | .... | .... | DB | .... |
| Sun Oil Co | Toledo, Ohio | | 2-47 | 450 | 520 | 1 | 75 | BW | 1.1 | 6.4 | 3.3 | 26.7 | DB | .... |
| American Potash & Chem | Trona, Calif | | 1948 | 435 | 720 | 2 | 190 | BW | ... | 15.2 | 7.9 | 31.8 | DB | 0 |
| Dow Chemical Co | Freeport, Tex | | 3-47 | 425 | 725 | 2 | 250 | RS | .... | .... | .... | .... | .... | .... |
| Farley & Loetscher Mfg | Dubuque, Ia | Laramore & Douglass | 10-47 | 425 | 750 | 1 | 45 | BW | 0.8 | 5.9 | .... | .... | DB | .... |
| Rhinelander Paper Co | Rhinelander, Wisc | | 8-47 | 425 | 580 | 1 | 90 | BW | 0.7 | 8.3 | 2.9 | .... | .... | 6.7 |
| Schmidt & Ault Paper | York, Pa | F L Smith | 9-47 | 410 | 750 | 1 | 127 | FW | 2.8 | 11.3 | 6.0 | 36.0 | DB | 3.4 |
| Hercules Powder Co | Parlin, N. J. | | 3-47 | 400 | 630 | . | ... | .... | ... | .... | .... | .... | .... | .... |
| National Gypsum Co | Baltimore, Md | Hall, Turpin & Wachter | 9-47 | 400 | .... | 2 | 60 | CE | .... | 8.0 | .... | .... | .... | .... |
| Security Mills, Inc | Newtonville, Mass | D D Emes | 1-47 | 400 | 550 | 1 | 25 | RS | 0.6 | 2.5 | .... | 33.6 | .... | 0.6 |
| Spreckels Sugar Co | San Francisco, Calif | | 8-47 | 400 | 560 | 1 | 175 | CE | 2.2 | 13.0 | 7.3 | 31.0 | .... | .... |
| A E Staley Mfg Co | Decatur, Ill | Burns & McDonnell | 6-48 | 400 | 700 | 3 | 125 | BW | 2.0 | 11.9 | 7.4 | 23.4 | .... | 6.4 |
| Union Pacific Coal Co | Rock Springs, Wyo | Stearns-Roger Mfg | 1947 | 400 | 700 | . | ... | .... | .... | .... | .... | .... | .... | .... |
| Utica Knitting Co | Utica, N. Y. | Gibbs & Hill | 10-47 | 400 | 540 | 2 | 50 | RS | 0.9 | 5.7 | 2.5 | 25.0 | .... | 1.9 |
| **200 TO 399 PSI** | | | | | | | | | | | | | | |
| American Box Board Co | Grand Rapids, Mich | H. C. Carroll | 9-47 | 350 | 600 | 1 | 75 | BW | 0.7 | 8.9 | 3.4 | 27.8 | .... | 4.9 |
| American Enka Corp | Enka, N. C. | | 9-47 | 350 | 725 | 1 | 105 | BW | 2.5 | 6.8 | 6.9 | 21.6 | DB | .... |
| University of Illinois | Champaign, Ill | Sargent & Lundy | 1-48 | 350 | 700 | 1 | 80 | BW | 1.3 | 9.7 | 3.6 | 29.6 | .... | 1.6 |
| Bergstrom Paper Co | Neenah, Wisc | | 9-47 | 300 | 570 | 1 | 60 | EC | 1.4 | 0.7 | .... | .... | .... | 2.9 |
| Chicago & Eastern Ill R R | Danville, Ill | | .... | 300 | Sat | 3 | 25 | Vo | ... | .... | .... | .... | .... | .... |
| Hooker Electrochemical Co | Tacoma, Wash | | 12-47 | 300 | Sat | 1 | 60 | BW | ... | 7.0 | 1.9 | .... | .... | .... |
| U. S. Rubber Co | Indianapolis, Ind | | 6-48 | 300 | 417 | 2 | 60 | BW | 0.3 | 7.3 | 2.1 | .... | .... | 0 |
| Narragansett Brewing Co | Cranston, R. I. | D T O'Neil | 6-47 | 265 | 511 | 1 | 40 | CE | 0.9 | 5.1 | 3.0 | .... | DB | 0 |
| Certain-teed Prod Co | York, Penna | | .... | 250 | Sat | 1 | 30 | EC | ... | .... | .... | .... | .... | .... |
| Chicago & Milwaukee R R | Minneapolis, Minn | | 9-47 | 250 | 500 | 2 | 50 | BW | ... | 7.1 | .... | 28.2 | .... | 0 |
| Eastman Gelatine Corp | Peabody, Mass | | .... | 250 | Sat | . | ... | .... | ... | .... | .... | .... | .... | .... |
| B D Eisendrath Tanning Co | Racine, Wisc | Karl Karlson | 8-47 | 250 | .... | 1 | 31.5 | CE | ... | .... | .... | .... | DB | 0 |
| Harshaw Chemical Co | Philadelphia, Pa | | 7-47 | 250 | Sat | 2 | 30 | CE | ... | .... | .... | .... | .... | .... |
| Latex Fiber Industries | Beaver Falls, N. Y. | | 3-47 | 250 | Sat | 1 | 23 | CE | ... | 3.9 | 0.7 | 29.7 | .... | 0 |
| Long Island Soap Co., Inc | Brooklyn, N. Y. | Walter M Keenan | 5-47 | 250 | Sat | 2 | 12 | EC | ... | .... | .... | .... | .... | .... |
| Plymouth Citrus Growers | Plymouth, Fla | | 3-47 | 250 | Sat | 1 | 44 | BW | 0.9 | 5.4 | .... | .... | .... | 0 |
| Southern Cotton Oil Co | Savannah, Ga | | 6-47 | 250 | Sat | 1 | 45 | BW | ... | 5.4 | .... | .... | .... | 0 |
| Texoma Natural Gas Co | Stinnett, Tex | | 6-47 | 250 | 7[2] 405 | 1 | 21 | CE | ... | .... | .... | .... | .... | .... |
| United Gas Pipe Line Co | Carthage, Tex | Stone & Webster | .... | 250 | Sat | 2 | 50 | CE | ... | 8.3 | 2.2 | .... | .... | .... |
| University of Michigan | Ann Arbor, Mich | Gummins & Barnard | 1-48 | 250 | 388 | 1 | 150 | WI | 2.0 | 15.0 | 6.0 | 27.9 | .... | 6.8 |
| Vacuum Foods Corp | Plymouth, Fla | Jackson & Moreland | 4-46 | 250 | Sat | 2 | 10 | BW | ... | 1.7 | .... | .... | .... | .... |
| | | | 4-46 | 250 | Sat | 1 | 16 | BW | ... | 2.5 | .... | .... | .... | .... |

**200 to 399 PSI—Continued on Next Two Pages**

A —Air cooled
Abe —Aluminum brass
AC —Allis-Chalmers Mfg Co
Ac —Arsenical copper
Ad —Admiralty
BA —J P Bartlett & Co
BW —Babcock & Wilcox Co
BWG —Babcock-Wilcox & Goldie-McCulloch Ltd
C —Coal, bituminous
CA —Coal, anthracite
CB —Cleaver-Brooks Co
CE —Combustion Engineering Co
CP —C A Parsons Ltd
Da —Damper
DB —Dry bottom
DBR —Dominion Bridge Co
Du —Duplex
EC —Erie City Iron Works
El —Elliott Co
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
H —Hydrogen cooled
HB —Heine Boiler Co
Hy —Hydraulic coupling
L —Lignite
LF —James Leffel & Co
M —Motor drive
Ms —Magnetic coupling
MT —Murray Iron Works Co
MS —Moore Steam Turbine Div
2Mp —Two motors per fan
MT —One motor, one turbine per fan
Mu —Munta metal
O —Oil
P —Pulverized-fuel firing
Pl —Plate
R —Regulator
Re —Regenerative

# or Under Construction Since April, 1946

| | | | F-D FANS | | I-D FANS | | | FUEL | | | FEED PUMPS | | TURBINES | | | | | | | CONDENSERS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 17.4 | 139.5 | Tu | M[2] | | Bl[3] | O[4] | O | P[5] | C | 13.8 | 2300 | T | S | 15.0 | 3600 | WE | 425 | 0 | H | ..... | .. | ..... | 2,550 | 89.0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | P | C, O | ..... | .... | ..... | .... | 7.5 | 3600 | GE | 125 | 2 | .. | ..... | .. | ..... | ..... | ..... |
| | | | | | | | | | | | | | | 10.0 | 3600 | GE | ... | 1 | .. | ..... | .. | ..... | ..... | ..... |
| .... | 31.4 | Re | M | | V | M | V | P | C, O | 13.5 | 2600 | 1M, 1T | R | .... | .... | .... | ... | .. | .. | ..... | .. | ..... | 485 | 10.0 |
| .... | .... | Tu | M | | S, Da | T | S | P | C | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | ..... | ..... |
| .... | 26.0 | Re | T | | V | T | S | ..... | O, G[6] | 18.0 | .... | T | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 790 | 12.0 |
| 3.4 | 11.3 | Tu | T | | S | T | S | UF(422) | C | 13.3 | 2100 | 1M, 3T | S, R | 7.5 | 3600 | GE | 20 | 2 | .. | ..... | .. | ..... | 1,485 | 39.8 |
| .... | .... | ... | M | | Da | ..... | Da | O | O | 18.7 | .... | 2M | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 117 | 0.2 |
| .... | 22.0 | Pl | T | | Da | T | S | P | C, O | 14.2 | 2500 | T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 640 | 19.0 |
| .... | 13.0 | Tu | MT | | Da | MT | Da | O, G | O, G | 18.4 | .... | 1M, 1T | R | 3.5 | 3600 | GE | 180 | 1 | A | ..... | .. | ..... | 250 | 7.0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | ..... | ..... | ..... | .... | ..... | ..... | 3.0 | 3600 | WE | ..... | 1 | A | 3.0 | 2 | Ad | 200 | 6.7 |
| 1.2 | 26.4 | Tu | M | | Da | MT | Da | P | C, O, G | 9.8 | 1900 | 1M, 1T | S, R | 2.5 | 3600 | AC | 45 | 1 | A | ..... | .. | ..... | 225 | 3.5 |
| .... | 12.5 | Re | T | | Da | T | S | P | C | 11.5 | 2200 | 2T | S | 4.0 | 3600 | AC | 1.0 | 1 | A | 2.9 | 2 | Ad | 200 | 5.0 |
| 9.6 | 18.0 | Tu | MT | | S, Da | MT | S, Da | SS(426) | C | [7]11.0 | 2060 | 1M, 2T | S | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 520 | 6.0 |
| 0 | 18.0 | Tu | T | | S | T | S | P | C, O, G[8] | 11.5 | 2100 | 1M, 3T | R | 5.0 | 3600 | GE | 195 | 0 | A | ..... | .. | ..... | 1,550 | 20.0 |
| 0 | 11.8 | Tu | M | | S, Hy | M | S, Hy | P | C | 14.2 | 2590 | 2T | R | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 230 | ..... |
| .... | 8.4 | Tu | M | | ..... | M | ..... | [9]..... | O[9] | 8.3[9] | .... | 1M, 1T | ..... | 3.5 | 3600 | GE | 15 | 1 | A | ... | .. | ..... | 310 | 6.5 |
| .... | 24.0 | Re | T | | S | T | S | O | O, G[10] | ..... | .... | 1M, 1T | R | 10.0 | .... | .... | ..... | .. | .. | ..... | .. | ..... | 450 | 15.0 |
| .... | O | ... | T | | Da | T | S, Da | O, G | G | 0.99 | .... | 3T | R | 4.0 | 3600 | GE | ..... | 2 | A | ..... | .. | ..... | 1,092 | 25.0 |
| .... | 23.8 | Re | M | | Da, V | M | V | P | C | 13.0 | 2300 | 1M, 1T | S | 6.0 | 3600 | GE | ..... | 2 | A | ..... | .. | ..... | ..... | ..... |
| .... | 23.8 | Re | M | | Da, V | M | V | P | C | 13.0 | 2300 | 1M, 1T | S | 6.0 | 3600 | GE | 1.0 | 2 | A | 3.7 | 2 | Ad | 850 | 18.0 |
| .... | 17.7 | Re | 2M, 1T | | Da | 2M, 1T | Da | P | C | 14.5 | 2400 | 2M, 1T | R | 5.0 | 3600 | WE | 5.0 | 2 | A | 3.0 | 2 | Ad | 450 | 15.0 |
| 2.5 | 0 | ... | M | | Da | M | Da | SS(192) | C | 14.0 | 2550 | 1M, 1T | S, R | 4.0 | 3600 | GE | 0.75 | 1 | A | 3.5 | 2 | Ad | 160 | 6.3 |
| 0 | 0 | ... | T | | S | T | Da | O | O | 1.1[11] | .... | 1M, 1T | R | 1.5 | 3600 | MS | 5.0 | 1 | A | ..... | .. | ..... | 105 | 3.0 |
| 3.7 | 0 | ... | M, T | | S, Da | MT | S, Ma | SS(170) | C | 13.0 | 2600 | 1M, 1Du | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 60 | ..... |
| 0 | .... | ... | T | | Da | M | Ma | P | C, O | 14.0 | 2600 | 1M, 2T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 225 | 0.75 |
| .... | 8.1 | Tu | T | | S | M | S | O, G | O | 18.8 | 1500 | 1M, 2T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 875 | ..... |
| .... | 8.1 | Tu | T | | S | M | S | O, G | O | 18.8 | 1500 | 1M, 2T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 875 | ..... |
| 6.0 | .... | ... | M | | Ma | M | Ma | O | O | 19.4 | .... | M | R | 5.0 | 3600 | WE | 1.0 | 2 | A | 5.5 | 1 | Ad | 260 | 12.0 |
| 0 | 0 | ... | ..... | | ..... | ..... | ..... | [9] | O | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 61 | 1.0 |
| .... | .... | ... | M | | V | ..... | ..... | TG(234) | C | 13.5 | 2465 | 2T | S | 1.5 | 3600 | WE | 55 | 1 | A | ..... | .. | ..... | 175 | 2.8 |
| 0 | 11.0 | Tu | 2Mp | | Da | M | S | P | C | 14.0 | 2300 | 2M | R | 15.0 | 3600 | GE | 0.75 | 2 | A | 8.5 | 2 | Ad | 670 | 25.0 |
| 0 | 18.5 | Tu | M | | V | M | Ma | P | C | 10.8 | 2200 | 1M, 1Du | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 220 | 9.0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | ST(100)[12] | [13]..... | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 40 | 0.9 |
| 0 | 1.9 | Tu | M | | S, V | M | S, Da | SS(93) | C, O | 14.8 | 2900 | 1M, 1T | R | 0.3 | 1200 | MS | 5.0 | 1 | A | ..... | .. | ..... | 63 | 0.6 |
| 0 | 6 | ... | M | | Da | ..... | ..... | O | O | ..... | .... | 2T | R | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | ..... | ..... |
| .... | .... | ... | ..... | | ..... | ..... | ..... | [14]..... | ..... | ..... | .... | 2M | R | 1.0 | 5030 | GE | 2.0 | 1 | A | 1.25 | 2 | Ad | 13.1 | 1.0 |
| .... | 5.7 | Tu | T | | S | T | S | O, G | O | 17.8 | .... | 1M, 1T | R | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 190 | ..... |
| 0 | .... | Tu | M | | Da | M | Da | O | O | 18.4 | .... | 1M, 1T | ..... | 7.5 | 3600 | GE | 47 | 0 | A | ..... | .. | ..... | 1,040 | 31.0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | G | G | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 1,750 | 90.0 |
| .... | 2.9 | Tu | M | | Da, V | M | Da | SS(165) | C[15] | 10.5 | 2150 | 2T | R | 2.0 | 3600 | AC | 1.0 | 1 | A | 1.5 | 2 | Ad | 45 | 2.0 |
| 6.7 | .... | ... | M | | Da | 2Mp | S, Da | UF(199) | C | 13.4 | 2550 | T | S, R | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | ..... | ..... |
| 3.4 | .... | ... | MT | | S, V | 1M, 1T | S, Da | SS(284) | C | 12.7 | 2000 | 2T | R | 4.0 | 3600 | WE | 65 | 1 | A | ..... | .. | ..... | 200 | 4.0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | ..... | ..... | ..... | .... | ..... | ..... | 1.5 | 3600 | GE | 35 | 0 | A | ..... | .. | ..... | 415 | 8.0 |
| .... | .... | ... | M | | V | M | Da | O | O | ..... | .... | M | R | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 60 | ..... |
| 0.6 | .... | ... | M | | ..... | M | ..... | O | O | 18.5 | .... | 1M, 1T | ..... | 0.8 | 1200 | MS | .... | 2 | A | ..... | .. | ..... | 25 | 0.8 |
| .... | 21.5 | Re | T | | S, V | T | S, Da | O, G | O | 18.2 | .... | 1M, 1T | ..... | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 565 | 2.1 |
| 6.4 | .... | ... | 2Mp | | Da | 2Mp | Ma | UF(474) | C | 10.0 | 1950 | 2T | S, R | 10.0 | 3600 | WE | 3.0 | 1 | A | ..... | .. | ..... | 920 | 24.5 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | P | C | ..... | .... | ..... | ..... | 7.5 | 3600 | GE | 0.75 | 2 | A | 8.0 | 2 | CuZn[16] | ..... | 25.0 |
| 1.9 | .... | ... | M | | Da | M | S | SS(154) | C | 13.2 | 2100 | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 165 | 1.0 |
| 4.9 | 0 | ... | T | | S | T | S | SS(185)[17] | C | 11.3 | 2050 | 3T | S | ..... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 225 | 4.2 |
| .... | 11.0 | Tu | T | | S | T | S | P | C | 14.0 | 2650 | ..... | ..... | 4.0 | 3600 | AC | 0.75 | 1 | A | 4.9 | 2 | Mu | 530 | 17.0 |
| 1.6 | 4.1 | Tu | 2Mp | | Da | 2Mp | Hy | TG(297) | C | 10.0 | .... | M | R | 3.0 | 3600 | GE | 1.0 | 2 | A | 3.5 | 2 | Ae | 320 | 9.0 |
| 2.9 | .... | ... | ..... | | ..... | ..... | ..... | UF(153) | C | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 180 | 2.5 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | SS | C | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | ..... | ..... |
| .... | 3.5 | Tu | M | | ..... | M | ..... | O | O | 18.4 | .... | 2M, 1T | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 125 | ..... |
| 0 | 0 | ... | 2Mp, MT | | Da | ..... | ..... | TG(173) | C | 10.5 | 2100 | 1M, 1T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 120 | ..... |
| 0 | 0 | ... | MT | | Da | ..... | Da | P | C, O | 14.4 | 2900 | 2T | R | 1.0 | 4500 | TE | 1.5 | 1 | A | 1.2 | 3 | Mu | 120 | 2.5 |
| 0 | 0 | ... | T, MT | | S | ..... | ..... | SS | ..... | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 121 | ..... |
| .... | .... | ... | ..... | | ..... | ..... | ..... | O | O | 19.0 | .... | ..... | ..... | 1.0 | 3600 | GE | 20 | 1 | A | ..... | .. | ..... | 130 | 2.5 |
| | | | | | | | | ..... | ..... | ..... | .... | ..... | ..... | 1.5 | 3600 | GE | 20 | 1 | A | ..... | .. | ..... | | |
| 0 | .... | ... | M | | Da | ..... | Da | SS(108) | C | 11.5 | .... | 2T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 52 | 0 |
| .... | .... | ... | ..... | | ..... | ..... | ..... | UF(98) | C | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 60 | ..... |
| 0 | 0 | ... | M | | Da | M | Da | UF | C | ..... | .... | 1M, 1T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 33 | ..... |
| .... | .... | ... | ..... | | ..... | ..... | ..... | C, CA | .... | ..... | .... | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | ..... | ..... |
| 0 | 1.3 | Tu | T | | Da | T | Da | O | O | ..... | .... | 2T | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 60 | ..... |
| 0 | 1.3 | Tu | M | | Da | T | Da | O | O | 18.3 | .... | 1T, 1Du | R | .... | 3000 | EI | 18 | .. | .. | ..... | .. | ..... | 100 | ..... |
| .... | .... | ... | ..... | | Da | ..... | Da | G | G | 1.07[11] | .... | 1M, 1Du | R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 63 | ..... |
| .... | .... | ... | ..... | | ..... | ..... | ..... | G | G | 1.5[11] | .... | 2M | R | .... | 3550 | EI | 25 | .. | .. | ..... | .. | ..... | 50 | ..... |
| 6.8 | 0 | ... | M | | Da | M | Da | UF(312) | C | 12.5 | 2100 | ..... | ..... | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 515 | 8.4 |
| .... | .... | Re | T | | Da | ..... | ..... | O | O | 18.4 | .... | 1M, 2T | S, R | .... | .... | .... | ..... | .. | .. | ..... | .. | ..... | 36 | ..... |
| .... | .... | Re | T | | Da | ..... | ..... | O | O | 18.4 | .... | | | | | | | | | | | | | |

—Riley Stoker Corp
—Speed control
—Skinner Engine Co
—Springfield Boiler Co
—Spreader stoker
—Slag tap
—Turbine drive
—Terry Steam Turbine Co
—Traveling-grate stoker
—Tubular

—Underfeed stoker
—Union Iron Works
—Vane control
—Henry Vogt Machine Co
—Wm Bros Blr & Mfg Co
—Westinghouse Electric Corp
—Wickes Boiler Co
—Heat release in cyclone only—Btu/sq ft/hr
—Axial flow fan

—Turbine-motor driven boiler feed pump
—Pressurized furnace
—Cyclone firing
—Acid sludge
—Includes waterwall surface
—Petroleum coke
—Bagasse furnace
—Blast furnace and coke oven gas
—Btu per cu ft
—Stoker, undesignated

—Coke
—Waste heat
—Wood shavings
—Copper zinc
—Water gas tar
—Wood waste
—Sub bituminous
—Smelt spout
(150)—Stoker grate area, sq ft

# Typical Industrials Above 200 ps

Compiled by J C McCabe
*Assistant Editor*

| Company | Location | Consulting Engineers | First Operation, Date | Initial Pressure, psi | Initial Steam Temperature, °F | BOILERS: Number | Capacity, Each, lb per hr | Manufacturer | Heating Surface, Each, sq ft | Heating Surface, Total, sq ft | Furnace Volume, Total, cu ft | Air Heater, Type, Each, sq ft per hr | Air-Heater Surface, per Boiler, Total, sq ft | Stoker | Economizer, Number | Economizer, Total Heating Surface, sq ft | Superheater, Number | Superheater, Total Heating Surface, sq ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **200 to 399 PSI—Continued from Preceding Pages** | | | | | | | | | | | | | | | | | | |
| American Crystal Sugar Co | Rocky Ford, Colo | | 10-47 | 225 | Sat | 1 | 115 | CE | 0.5 | 12.9 | 12.4 | 25.0 | DB | 0 | 0 | 0 | 0 | 0 |
| Carey Salt Co | Hutchinson, Kans | | 9-47 | 225 | 500 | 3 | 24 | BW | ... | 5.0 | .... | 26.0 | .... | 0 | 0 | 0 | 0 | 0 |
| | | | 9-47 | 225 | 500 | 2 | 40 | BW | ... | 6.4 | .... | 26.0 | .... | 0 | 0 | 0 | 0 | 0 |
| B F Goodrich Co | Marietta, Ohio | | 6-47 | 215 | 440 | 3 | 40 | BW | 1.1 | 5.5 | 1.7 | 30.9 | .... | .... | .... | .... | .... | .... |
| American Stove Co | St. Louis, Mo | | 4-47 | 200 | Sat | 1 | 29 | EC | 0.1 | 4.2 | 1.5 | 19.6 | DB | 0 | 0 | 0 | 0 | 0 |
| American Woolen Co | Dover, N. H | | .... | 200 | 381 | 2 | 40 | CE | ... | 5.0 | .... | .... | .... | .... | .... | .... | .... | .... |
| Anonymous | Bridesburg, Pa | Stone & Webster | 5-47 | 200 | 388 | 3 | 75 | BW | 1.4 | 6.8 | 3.9 | 23.4 | DB | .... | .... | .... | .... | 2 |
| Antigo Milk Prod Co-op | Antigo, Wisc | | .... | .... | 370 | 1 | 25 | BA | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| | | | .... | .... | 370 | 1 | 35 | CE | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Borden Co | Waukesha, Wisc | | 8-47 | 200 | Sat | 1 | 50 | EC | 1.0 | 5.9 | .... | 28.0 | DB | 0 | 3 | 0 | 0 | 0 |
| Carborundum Co | Niagara Falls, N. Y | | 11-47 | 200 | Sat | 1 | 100 | EC | 2.8 | 9.9 | .... | 20.4 | DB | 0 | 8 | 0 | 0 | 0 |
| Consolidated Edison Co | Bronx, N. Y | | 5-46 | 200 | 388 | 2 | 50 | UI | ... | 5.2 | 2.0 | .... | DB | 0 | 4 | 0 | 0 | 0 |
| Curtis Publishing Co | Sharon Hill, Pa | Stone & Webster | 4-47 | 200 | 388 | 2 | 65 | CE | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Fir Mfg Co | Myrtle Creek, Ore | C C Moore | 5-47 | 200 | Sat | 1 | 70 | BW | 1.6 | 4.9 | .... | .... | .... | .... | .... | .... | .... | .... |
| Interchemical Corp | Bound Brook, N. J | C L Olmstead | 2-47 | 200 | 388 | 2 | 5.0 | CB | ... | 0.6 | .... | .... | .... | .... | .... | .... | .... | .... |
| Ohio State University | Columbus, Ohio | Sargent & Lundy | 10-47 | 200 | 615 | 1 | 100 | BW | 2.1 | 8.3 | 6.2 | 20.8 | DB | .... | 11 | .... | .... | .... |
| Philadelphia Quartz Co | South Gate, Calif | J W McPherson | 6-47 | 200 | Sat | 2 | 21 | BW | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Pittsburgh Plate Glass Co | Milwaukee, Wisc | | 12-47 | 200 | 560 | 1 | 22 | CE | ... | 3.5 | 1.0 | .... | DB | .... | .... | .... | .... | .... |
| Premier Oil Refining Co | Cotton Valley, La | | 2-47 | 200 | 388 | 2 | 54 | BW | 1.1 | 6.5 | 1.7 | 42.0 | .... | 0 | 0 | .... | .... | .... |
| Red Wing Co, Inc | Fredonia, N. Y | | 10-46 | 200 | Sat | 2 | 30 | BW | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| H H Robertson Co | Ambridge, Pa | | 12-46 | 200 | Sat | 3 | 15 | BW | ... | 5.0 | .... | .... | DB | .... | .... | .... | .... | .... |
| State Teachers College | Valley City, N. D | Pfeifer & Schultz | 9-47 | 200 | 400 | . | ... | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Tobin Packing Co | Ft Dodge, Ia | H K Eillman | 10-46 | 200 | Sat | 1 | 50 | WB | ... | .... | .... | .... | DB | .... | .... | .... | .... | .... |
| Washington State College | Pullman, Wash | H W Beecher | 10-47 | 200 | Sat | 1 | 60 | BW | 0.8 | 4.5 | 2.0 | 30.7 | .... | .... | 2.1 | .... | .... | .... |
| **CANADA** | | | | | | | | | | | | | | | | | | |
| **500 PSI AND ABOVE** | | | | | | | | | | | | | | | | | | |
| Pacific Mills, Ltd | Ocean Falls, B. C | | ..... | 750 | 725 | 1 | 175 | BWG | 3.8 | 15.6 | 11.0 | 19.3 | DB | 0 | 21 | 0 | 0 | 0 |
| | | | ..... | 750 | 725 | 1 | 175 | BWG | 3.8 | 15.6 | 11.0 | 19.3 | DB | 0 | 21 | 0 | 0 | 0 |
| Westminster Paper Co | New Westminster, B. C | W O Stevens | 7-47 | 600 | 725 | 1 | 45 | FW | 1.7 | 4.5 | 3.2 | 24.2 | DB | .... | 7 | .... | .... | .... |
| Donnaconna Paper Co, Ltd | Donnaconna, Que | | 1-48 | 500 | Sat | 2 | 90 | CE | 1.8 | 9.1 | .... | 23.0 | DB | 0 | 3 | .... | .... | .... |
| **400 TO 499 PSI** | | | | | | | | | | | | | | | | | | |
| Canadian Utilities, Ltd | Drumheller, Que | Haddin & Miles | 10-47 | 450 | 750 | 1 | 100 | CE | 2.4 | 11.5 | .... | .... | DB | .... | 9 | .... | .... | .... |
| Great Lakes Paper Co | Fort William, Ont | Stadler-Hurter & Co | 9-47 | 450 | 650 | 1 | 100 | CE | 2.2 | 12.1 | .... | .... | DB | .... | 10 | .... | .... | .... |
| Rolland Paper Co | Mont-Rolland, Que | | 10-47 | 450 | .... | 1 | 40 | BWG | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Saskatchewan Pwr Comm | Estevan, Sask | R A Hanright | 12-47 | 450 | 750 | 1 | 80 | CE | 1.0 | 9.6 | .... | 30.0 | .... | .... | 4 | .... | .... | .... |
| **200 TO 399 PSI** | | | | | | | | | | | | | | | | | | |
| Canadian Pacific Rwy Co | Calgary, Alta | | 9-47 | 250 | 520 | 2 | 30 | BWG | ... | 5.9 | 1.7 | 30.0 | .... | .... | .... | .... | .... | .... |
| Long Lac Pulp & Paper Co | Terrace, Ont | Stadler-Hurter & Co | 9-48 | 250 | Sat | 1 | 120 | CE | ... | 22.9 | 5.3 | .... | 20 | .... | .... | .... | .... | .... |
| Naugatuck Chemicals | Elmira, Ont | R A Hanright | 1-48 | 250 | 406 | 2 | 20 | CV | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Sisters of Charity | Vancouver, B. C | | 8-47 | 225 | Sat | 2 | 12 | BWG | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Canadian Internat Paper | Gatineau, Que | | 1-47 | 200 | 435 | 1 | 200 | CE | 5.3 | 13.1 | 11.8 | 17.6 | DB | .... | 19 | .... | .... | .... |
| Melchers Distilleries | Berthierville, Que | J A Kearns | 7-46 | 200 | 420 | 2 | 35 | DBR | 0.8 | 5.0 | 2.1 | 21.7 | .... | .... | 5 | .... | .... | .... |
| Quebec North Shore Paper | Baie Comeau, Que | | 5-47 | 200 | 388 | 1 | 90 | FW | 1.6 | 8.8 | .... | .... | .... | .... | .... | .... | .... | .... |
| University of Manitoba | Winnipeg, Man | N M Hall | 1-48 | 200 | 450 | 1 | 50 | FW | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |

# Typical Municipal Plants Installed and

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UNITED STATES** | | | | | | | | | | | | | | | | | | |
| City of Los Angeles | Wilmington, Calif | | 11-47 | 1050 | 900 | 1 | 570 | RS | 6.8 | 24.1 | 22.5 | 32.2 | .... | 12.0 | 64 | .... | .... | .... |
| City of Lansing | Lansing, Mich | Burns & Roe | 7-48 | 864 | 900 | 1 | 275 | BW | ... | .... | 15.7 | 20.6 | ST | 11.6 | .... | .... | .... | .... |
| City of Pasadena | Pasadena, Calif | O H Hedrich | 12-48 | 850 | 900 | 2 | 250 | CE | 3.1 | 12.2 | .... | 31.9 | .... | 0 | 34 | .... | .... | .... |
| Coffeyville Municipal | Coffeyville, Kan | Black & Veatch | 3-48 | 650 | 825 | 2 | 125 | BW | 3.1 | 10.7 | 7.4 | 18.0 | .... | 0 | 17 | .... | .... | .... |
| City Electric Dept | Rochester, Minn | Sargent & Lundy | 9-48 | 625 | 830 | 1 | 90 | RS | 4.5 | 9.0 | 6.5 | 18.0 | DB | 0 | 11 | .... | .... | .... |
| Glendale Public Serv Dept | Glendale, Calif | O H Hedrich | 8-47 | 625 | 825 | 1 | 200 | CE | 2.6 | 12.4 | .... | 36.0 | .... | 0 | 19 | .... | .... | .... |
| City of Holyoke | Holyoke, Mass | McClintock & Craig | 11-47 | 485 | 750 | 1 | 60 | RS | 2.6 | 6.7 | 3.7 | 21.3 | DB | 0 | 9 | .... | .... | .... |
| City of Springfield | Springfield, Minn | C Foster | 2-47 | 475 | 750 | 1 | 35 | WB | ... | .... | .... | 25.0 | .... | .... | 5 | .... | .... | .... |
| City of Ames | Ames, Iowa | | 4-47 | 450 | 750 | 1 | 60 | MI | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| City of Sibley | Sibley, Iowa | R D Thomas | 11-47 | 450 | 750 | 1 | 60 | MI | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Greenwood Lt & Wtr Plt | Greenwood, Miss | | 1948 | 450 | 750 | 1 | 90 | BW | ... | .... | .... | .... | DB | 0 | 12 | .... | .... | .... |
| McPherson Water & Elec Dept | McPherson, Kan | | 8-47 | 450 | 750 | 1 | 100 | RS | 1.6 | 10.6 | 5.2 | .... | .... | 0 | 10 | .... | .... | .... |
| City of Hastings | Hastings, Neb | Black & Veatch | .... | 425 | 825 | 1 | 70 | BW | 1.9 | 6.5 | 5.0 | .... | .... | 2.7 | 10 | .... | .... | .... |
| Painesville Municipal | Painesville, Ohio | N R Hadlow | 8-47 | 425 | 750 | 1 | 125 | BW | 0.7 | 11.5 | 5.3 | 31.5 | .... | 0 | 6 | .... | .... | .... |
| Bd of Water, Elec, Gas & Pwr | Austin, Minn | J V Edeskuty | 1947 | 425 | 750 | 1 | 125 | RS | 4.4 | 10.0 | 6.9 | 23.7 | DB | 0 | 2 | .... | .... | .... |
| Board of Public Works | Alexandria, Minn | Pfeiffer & Shultz | 11-48 | 400 | 750 | 1 | 60 | BW | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Department of Public Util | Colorado Springs, Colo | | 8-49 | 400 | 750 | 1 | 150 | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Light & Water Dept | Fairbury, Neb | Black & Veatch | 12-47 | 400 | 750 | 1 | 60 | EM | 2.2 | 7.6 | .... | 19.9 | DB | 0 | .... | .... | .... | .... |
| City of Moorehead | Moorehead, Minn | Helmick, Edeskuty & Luta | 5-47 | 400 | 750 | 1 | 55 | BW | 0.7 | 6.7 | 3.0 | 26.0 | .... | 0 | .... | .... | .... | .... |
| Board of Public Utilities | Kansas City, Kan | Burns & McDonnell | 5-47 | 400 | 725 | . | ... | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| City of Frankfort | Frankfort, Ind | Emery, Marker & Emery | 7-48 | 400 | 725 | 1 | 110 | BW | 1.2 | 12.3 | .... | .... | .... | 2.9 | .... | .... | .... | .... |
| Water & Light Dept | Virginia, Minn | Laramore & Douglass | 10-47 | 400 | 700 | 2 | 60 | EM | 1.9 | 6.5 | 2.7 | .... | .... | 0 | .... | .... | .... | .... |
| Orrville Municipal Utilities | Orrville, Ohio | H R Hadlow | 1948 | 250 | 750 | . | ... | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **CANADA** | | | | | | | | | | | | | | | | | | |
| City of Montreal | Montreal, Que | J A Kearns | 10-47 | 150 | 365 | 2 | 7 | VK | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... |

# Continued From Preceding Two Pages

| | | | F-D FANS | | I-D FANS | | | FUEL | | | FEED PUMPS | | TURBINES | | | | | | CONDENSERS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |

# Typical Industrials Under 200 psi Built or on Order Since April 1946

Compiled by J C McCabe
Assistant Editor

| Company | Location | First Operation, New Units | Nominal Pressure, Psi | Nominal Steam Temperature, F | BOILERS: Number | BOILERS: Capacity, Each, 1000 lb per hr | BOILERS: Manufacturer | Fuel | TURBINES: Capacity, 1000 kw | TURBINES: Speed, rpm | TURBINES: Manufacturer | TURBINES: Exhaust Pressure, psia | TURBINES: No. of Bleed Points | Total Boiler Capacity for New Units, 1000 lb | Total Generator Capacity for New Units, 1000 kw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **160 TO 199 PSI** | | | | | | | | | | | | | | | |
| Borden Co. | Kankakee, Ill. | 7-47 | 175 | Sat | 2 | 10 | EC | SS | .... | .... | .... | .... | .. | 20 | .... |
| Interlake Iron Corp. | Erie, Penna. | 7-46 | 175 | 450 | 1 | 75 | EC | G | .... | .... | .... | .... | .. | 175 | .... |
| Roegelein Provision Co. | San Antonio, Tex. | 4-47 | 175 | Sat | 1 | 18 | Vo | O | .... | .... | .... | .... | .. | 26 | .... |
| Alba Mfg Co. | Aurora, Ill. | 5-47 | 170 | Sat | 1 | 17 | BW | TG (66) | .... | .... | .... | .... | .. | 50 | .... |
| American Fork & Hoe Co. | Ashtabula, Ohio. | 10-47 | 165 | Sat | 2 | 15 | BW | CA | .... | .... | .... | .... | .. | 47 | 0.5 |
| | | 10-47 | 165 | Sat | 1 | 17 | CB | O | | | | | | | |
| American Rolling Mill Co. | Middletown, Ohio. | 10-47 | 165 | 500 | 2 | 100 | BW | UF (262) | .... | .... | .... | .... | .. | 625 | .... |
| Lacon Woolen Mills Co. | Lacon, Ill. | ..... | 165 | Sat | 1 | 30 | MI | UF (112) | 0.3 | 200 | SE | 5.0 | .. | 70 | 0.3 |
| | | ..... | 165 | Sat | 1 | 40 | MI | ..... | | | | | | | |
| Marin Dell Milk Co. | Hughson, Calif. | ..... | 165 | Sat | 1 | 25 | BW | CA, O | .... | .... | .... | .... | .. | 50 | .... |
| Abrasive Products Inc. | So Braintree, Mass. | 9-47 | 160 | 348 | 1 | 13 | BW | O | .... | .... | .... | .... | .. | 39 | .... |
| Crystal Bottling Co. | Trinidad, Colo. | 6-47 | 160 | 370 | 1 | 25 | WB | SS (548) | .... | .... | .... | .... | .. | 60 | .... |
| Easton Laundries Inc. | Easton, Penna. | 4-47 | 160 | Sat | 1 | 18 | EC | TG | 0.2 | 225 | .... | 5.0 | .. | 25 | 0.2 |
| Evens & Howard Sewer Pipe | St Louis, Mo. | 1-47 | 160 | Sat | 1 | 18 | CB | O | .... | .... | .... | .... | .. | 36 | .... |
| Filice & Perrelli Canning | Richmond, Calif. | ..... | 160 | 210 | 1 | 35 | BW | O | .... | .... | .... | .... | .. | 50 | .... |
| General Motors Proving Gd. | Milford, Mich. | 2-47 | 160 | Sat | 1 | 35 | BW | O | .... | .... | .... | .... | .. | .... | .... |
| Lac Chemicals, Inc. | Culver City, Calif. | 4-47 | 160 | Sat | 2 | 15 | EC | O, G | .... | .... | .... | .... | .. | 48 | .... |
| Maltine Co. | Morris Plains, N. J. | 8-47 | 160 | 370 | 2 | 6 | BW | O | .... | .... | .... | .... | .. | 24 | .... |
| Oregon Trunk Rwy Co. | Wishram, Wash. | 6-47 | 160 | Sat | 2 | 7.5 | BW | CA | .... | .... | .... | .... | .. | 15 | .... |
| Pet Milk Co. | Mayfield, Ky. | 10-47 | 160 | Sat | 1 | 25 | EC | UF | .... | .... | .... | .... | .. | 50 | 2.4 |
| Royal Tallow & Soap Co. | Petaluma, Calif. | 3-47 | 160 | Sat | 2 | 19.5 | BW | CA | .... | .... | .... | .... | .. | 33.5 | .... |
| Scovill Mfg Co. | Waterville, Conn. | 1946 | 160 | 466 | 1 | 45 | RS | C | .... | .... | .... | .... | .. | 80 | 1.25 |
| Textron, Inc. | Manchester, N. H. | 6-47 | 160 | 270 | 2 | 27 | BW | O | .... | .... | .... | .... | .. | 27 | .... |
| Tri-Valley Packing Assoc. | San Jose, Calif. | 5-47 | 160 | Sat | 2 | 30 | WB | O, G | .... | .... | .... | .... | .. | 60 | .... |
| Valdese Mfg Co. | Valdese, N. C. | 6-47 | 160 | Sat | 2 | 10 | EC | UF | .... | .... | .... | .... | .. | .... | .... |
| Velsicol Corp. | Marshall, Ill. | 4-47 | 160 | 363 | 1 | 21 | BW | O | .... | .... | .... | .... | .. | 48 | .... |
| **150 TO 159 PSI** | | | | | | | | | | | | | | | |
| American Cyanamid Co. | Piney River, Va. | 9-46 | 150 | Sat | 1 | 40 | RS | SS | .... | .... | .... | .... | .. | 80 | .... |
| American Home Foods, Inc. | Rochester, N. Y. | 6-47 | 150 | Sat | 1 | 49 | BW | SS | .... | .... | .... | .... | .. | 75 | .... |
| Barton Distilling Co. | Bardstown, Ky. | 7-47 | 150 | 370 | 1 | 45 | Vo | UF (111) | .... | .... | .... | .... | .. | 140 | .... |
| Borden Co. | Boscobel, Wisc. | 7-47 | 150 | 366 | 2 | 20 | EC | SS (95) | .... | .... | .... | .... | .. | 40 | .... |
| E J Brach & Sons | Chicago, Ill. | 12-47 | 150 | 350 | 1 | 60 | BW | TG (160) | .... | .... | .... | .... | .. | 120 | .... |
| Bridgeport Brass Co. | Bridgeport, Conn. | 1-48 | 150 | 465 | 2 | 50 | EM | O | .... | .... | .... | .... | .. | 150 | 1.25 |
| Brockway Glass Co, Inc. | Brockway, Penna. | 6-47 | 150 | 362 | 1 | 10 | EC | UF (24) | .... | .... | .... | .... | .. | 20 | .... |
| Brunswick Ind Block | Dubuque, Ia. | 10-47 | 150 | Sat | 2 | 33 | MI | SS | .... | .... | .... | .... | .. | 90 | .... |
| Caterpillar Tractor Co. | Peoria, Ill. | 10-47 | 150 | Sat | 2 | 50 | BW | TG | 0.1 | .... | GE | .... | .. | 450 | 0.1 |
| Chicopee Mfg Co. | Chicopee Falls, Mass. | 10-47 | 150 | 366 | 1 | 19 | BW | CA | .... | .... | .... | .... | .. | .... | .... |
| Gehl Guernsey Farms | Germantown, Wisc. | 3-47 | 150 | Sat | 2 | 25 | WI | SS | 0.5 | 3600 | AC | 5.0 | 1 | 50 | 0.5 |
| Gulf Research & Develop. | Harmarville, Penna. | 11-47 | 150 | 366 | 2 | 20 | BW | O, G | .... | .... | .... | .... | .. | 40 | .... |
| Gunther Brewing Co. | Baltimore, Md. | 7-47 | 150 | ... | 1 | 42 | BW | O | .... | .... | .... | .... | .. | 100 | .... |
| Harris Safety Deposit | Chicago, Ill. | 1947 | 150 | 345 | 1 | 18 | Vo | UF | .... | .... | .... | .... | .. | 42 | 0.5 |
| Hewitt Soap Co. | Dayton, Ohio. | 8-47 | 150 | Sat | 1 | 40 | BW | UF (112) | 0.1 | 3500 | El | 20 | .. | 40 | 0.1 |
| Horn & Hardart Co. | New York, N. Y. | 8-47 | 150 | Sat | 3 | 21 | BW | O | .... | .... | .... | .... | .. | 63 | .... |
| International Lubricant | Southport, La. | 8-47 | 150 | 350 | 1 | 15 | EC | G | .... | .... | .... | .... | .. | 20 | .... |
| Chas A Krause Milling Co. | Milwaukee, Wisc. | 11-47 | 150 | 359 | 2 | 25 | BW | UF (74) | .... | .... | .... | .... | .. | 85 | .... |
| Libbey-Owens-Ford Glass | Toledo, Ohio. | 3-47 | 150 | 382 | 1 | 100 | BW | P | .... | .... | .... | .... | .. | 292 | .... |
| Marion Power Shovel Co. | Marion, Ohio. | 9-47 | 150 | ... | 2 | 35 | WI | SS (122) | .... | .... | .... | .... | .. | 70 | .... |
| Penna Training School | Morganza, Penna. | 2-47 | 150 | 366 | 3 | 22 | BW | UF (63) | 0.25<br>0.35<br>0.15 | 200<br>164<br>157 | ....<br>....<br>.... | 195<br>195<br>195 | ..<br>..<br>.. | 66 | 0.75 |
| Perfect Circle Co. | Hagerstown, Ind. | 6-46 | 150 | Sat | 1 | 10 | RS | UF (51) | .... | .... | .... | .... | .. | 26 | .... |
| Plastic Film Corp. | Plainfield, Conn. | 8-47 | 150 | Sat | 1 | 104 | CB | O | .... | .... | .... | .... | .. | 345 | .... |
| Plywood Plastics Corp. | Hampton, S. C. | 7-47 | 150 | Sat | 2 | 15 | BW | O | .... | .... | .... | .... | .. | 150 | .... |
| Shell Oil Co, Inc. | Sewaren, N. J. | 11-47 | 150 | 325 | 1 | 75 | BW | O | .... | .... | .... | .... | .. | 135 | .... |
| Shenango Pottery Co. | New Castle, Penna. | 8-47 | 150 | Sat | 1 | 20 | BW | UF (88) | .... | .... | .... | .... | .. | .... | .... |
| Sherwin-Williams Co. | Bound Brook, N. J. | 6-47 | 150 | Sat | 1 | 20 | BW | O | .... | .... | .... | .... | .. | 50 | .... |
| So Calif Citrus Foods | Anaheim, Calif. | 2-47 | 150 | Sat | 2 | 12 | EC | O, G | .... | .... | .... | .... | .. | 24 | .... |
| United Wallpaper, Inc. | Aurora, Ill. | 7-47 | 150 | 366 | 3 | 35 | BW | O | .... | .... | .... | .... | .. | 105 | .... |
| West Texas Gas Co. | Fritch, Tex. | 1947 | 150 | 450 | 1 | 10 | BW | O | .... | .... | .... | .... | .. | .... | .... |
| **149 PSI AND BELOW** | | | | | | | | | | | | | | | |
| Blue Ridge Glass Corp. | Kingsport, Tenn. | 1947 | 140 | Sat | 1 | 10 | BW | SS (90) | .... | .... | .... | .... | .. | 25 | .... |
| Iowa Training School | Eldora, Ia. | 1947 | 140 | Sat | 4 | 10 | MI | TG (88) | .... | .... | .... | .... | .. | 50 | 0.4 |
| Mayview State Hospital | Mayview, Penna. | 7-47 | 140 | Sat | 1 | 30 | SP | UF | .... | .... | .... | .... | .. | 120 | 0.8 |
| Fairbanks Co. | Binghamton, N. Y. | 6-47 | 135 | 350 | 1 | 14 | EC | O | .... | .... | .... | .... | .. | 20 | .... |
| Sheffield Steel Corp. | Kansas City, Mo. | 8-47 | 130 | 350 | 1 | 35 | BW | O, G | .... | .... | .... | .... | .. | 112 | .... |
| Bell Telephone Labs. | Murray Hill, N. J. | 1947 | 125 | Sat | 2 | 13.6 | BW | O | .... | .... | .... | .... | .. | .... | .... |
| Chain Belt Co. | Milwaukee, Wisc. | 8-48 | 125 | 353 | 1 | 50 | EC | UF (149) | .... | .... | .... | .... | .. | 95 | .... |
| Cook Yarn Dye Mills | Phillipsdale, R. I. | 1-47 | 125 | 355 | 1 | 17 | CB | O | .... | .... | .... | .... | .. | 38 | .... |
| W J Dickey & Sons | Oella, Md. | 7-47 | 125 | Sat | 1 | 25 | CE | UF (84) | .... | .... | .... | .... | .. | 47 | .... |
| Eagle Picher Co. | Wabash, Ind. | 3-47 | 125 | 380 | 1 | 18 | Vo | SS | .... | .... | .... | .... | .. | 27 | .... |
| Fremont Rubber Co. | Fremont, Ohio. | 5-47 | 125 | 350 | 1 | 13 | EC | O | .... | .... | .... | .... | .. | 30 | .... |
| Holfast Rubber Co. | Atlanta, Ga. | 3-47 | 125 | 344 | 1 | 25 | BW | O | .... | .... | .... | .... | .. | 35 | .... |
| Hudson Oil Co. | Newark, N. J. | 10-47 | 125 | 350 | 1 | 14 | BW | O | .... | .... | .... | .... | .. | 21 | .... |
| Hutchinson Co-op | Hutchinson, Minn. | 1947 | 125 | Sat | 2 | 15 | LB | O | .... | .... | .... | .... | .. | 30 | .... |
| Kingan & Co. | Storm Lake, Ia. | 2-47 | 125 | 350 | 2 | 14 | CB | O | .... | .... | .... | .... | .. | 27.6 | .... |
| Liberty Fabrics | New York, N. Y. | 1947 | 125 | 478 | 1 | 9 | EC | O | .... | .... | .... | .... | .. | .... | .... |
| Mastic Asphalt Corp. | Elizabeth, N. J. | 7-47 | 125 | 344 | 1 | 12 | BW | O | .... | .... | .... | .... | .. | .... | .... |
| McKeesport Hospital | McKeesport, Penna. | 11-47 | 125 | Sat | 1 | 20 | BW | UF (70) | .... | .... | .... | .... | .. | 40 | .... |
| Medley Distilling Co. | Owensboro, Ky. | ..... | 125 | 340 | 1 | 20 | BW | UF (96) | .... | .... | .... | .... | .. | .... | .... |
| Pacific Mills | Columbia, S. C. | ..... | 125 | Sat | 2 | 10 | BW | SS | .... | .... | .... | .... | .. | .... | .... |
| Potash Co of America | Carlsbad, N. M. | 5-47 | 125 | Sat | 1 | 36 | BW | G | .... | .... | .... | .... | .. | 60 | .... |
| R C A Rubber Co. | Akron, Ohio. | 5-47 | 125 | Sat | 1 | 24 | BW | UF (79) | .... | .... | .... | .... | .. | 36 | .... |
| Rubber Industries | Keokuk, Ia. | 1947 | 125 | 352 | 1 | 30 | BW | SS (88) | .... | .... | .... | .... | .. | .... | .... |
| | | 1947 | 125 | 352 | 1 | 20 | MI | SS (56) | .... | .... | .... | .... | .. | .... | .... |
| Sardick Food Prod. | Turlock, Calif. | 8-46 | 125 | Sat | 2 | 7.5 | HB | O | .... | .... | .... | .... | .. | 15 | .... |
| Tomlinson | High Point, N. C. | 1-47 | 125 | 353 | 2 | 12 | BW | SS (42) | .... | .... | .... | .... | .. | 24 | .... |
| Uddo & Taormina Co. | Vineland, N. J. | 8-46 | 125 | Sat | 2 | 10 | EC | CA | .... | .... | .... | .... | .. | 40 | .... |
| | | 8-46 | 125 | Sat | 1 | 20 | EC | CA | | | | | | | |
| Ansbacher-Siegle Corp. | Staten Island, N. Y. | 5-47 | 120 | Sat | 1 | 11 | CE | O | .... | .... | .... | .... | .. | 53 | 0.6 |
| Carney Co. | Mankata, Minn. | 1947 | 120 | Sat | 1 | 22 | MI | SS | .... | .... | .... | .... | .. | 22 | .... |
| Landers, Frary & Clark | New Britain, Conn. | 6-47 | 120 | 350 | 1 | 40 | BW | CA | .... | .... | .... | .... | .. | 160 | .... |
| Olympia Brewing Co. | Olympia, Wash. | 7-47 | 115 | Sat | 1 | 20 | RS | CA | .... | .... | .... | .... | .. | 40 | .... |
| Crystal Laundry | New York, N. Y. | 1947 | 110 | 350 | 1 | 59 | CB | OO | .... | .... | .... | .... | .. | .... | .... |
| Glasgo Finishing Co. | Voluntown, Conn. | 7-46 | 110 | 340 | 2 | 12 | CB | OO | .... | .... | .... | .... | .. | .... | .... |

# U. S. and Canada Hit New High in Hydro: Over 4,000,000 Hp on Order

► HYDROELECTRIC PLANTS, like steam stations, are enjoying an unprecedented construction boom. About the same number of projects are reported this year as were recorded in our June 1946 tables, which represented a 5-year period. Over 3,150,000 hp of new hydroelectric-plant capacity are on order for or are being installed in U. S. projects, as shown on pages 74 to 77. Of this, over 500,000 hp capacity are being constructed by public utilities.

At the end of 1945 there were 24,000,000 hp installed in waterpower plants in the U. S. During the nine years from 1937 to 1945, waterpower capacity increased 900,000 hp a year. Because of conditions growing out of the war, only about 15,000 hp of new capacity went into service last year. Fig. 1. Within the next two years this condition will be corrected, with 600,000 hp scheduled for operation this year, and 1,300,000 hp for 1948.

Over 80% of the new hydro-plant capacity on order is being installed by Federal Government agencies, as shown on page 78. The table shown here lists 64 plants designed for nearly 13,000,000-hp ultimate capacity, of which nearly 7,000,000 hp have been installed and 2,700,000 hp are now being erected or are on order. See map on page 98.

Most of these plants, particularly the more important ones, have been or are being installed by U. S. Bureau of Reclamation, U. S. Engineer Corps and Tennessee Valley Authority. Because the latter's construction program is pretty well completed, future developments will probably be done largely by U. S. Bureau of Reclamation and U. S. Engineer Corps.

### MISSOURI RIVER

On the Missouri River about 100 dams will eventually be constructed to provide more than 100,000,000 acre-ft of storage. This program, now well under way, will require many years to complete. Eight important dams with their power plants are completed and in operation, and an equal number are under construction, page 98. Among the ones completed is Fort Peck with the largest earth-fill dam in the world. Other comparable dams either under construction or being planned by U. S. Engineer Corps are Garrison, Oane and Fort Randall.

The Columbia River development is the greatest of all Government power projects, with two huge plants in operation: Bonneville is completed, with 729,000 hp; Grand Coulee, built by U. S. Bureau of Reclamation, is the stem of the Columbia River basin development. It now has 928,000 hp installed in six main units, with a 150,000-hp name-plate rating and two 14,000-hp service units. Six more units are on order, three with a name-plate rating of 150,000 hp and three of 165,000 hp. All main units are good for 165,000 hp continuously, which will give the plant an ultimate rating that amounts to 3,012,000 hp.

Government power agencies, Federal, state and municipal, have grown to where they produced 42,000,000,000 kwhr last year, Fig. 2. Of this amount the Tennessee Valley Authority generated 12,314,000,000 and the Bonneville Power Administration 6,236,000,000, a decrease for the latter of nearly 3,000,000,000 kwhr below 1945 generation. Most of this decrease was in Grand Coulee plant where two machines have been removed for installation in Shasta plant. These machines were built originally for Shasta but were installed in Grand Coulee to help supply war load.

For 1946 power generation in all utility plants was over 223,000,000,000.

(*Continued on page* 78)

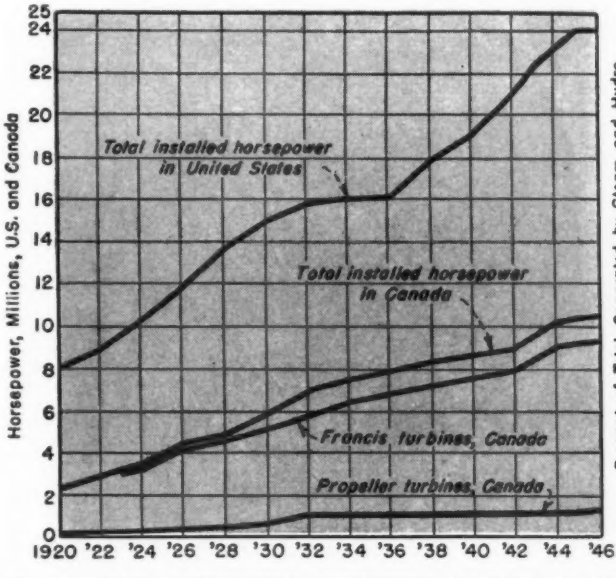

Horsepower, Millions, U.S. and Canada
Percent of Total Generated by Steam and Hydro
Total installed horsepower in United States
Total installed horsepower in Canada
Francis turbines, Canada
Propeller turbines, Canada
1920 '22 '24 '26 '28 '30 '32 '34 '36 '38 '40 '42 '44 '46

Fig. 1—Total hydroelectric horsepower installed in the U. S. and Canada during the last 26 years. In U. S., only 15,000 hp of new hydro capacity was installed last year

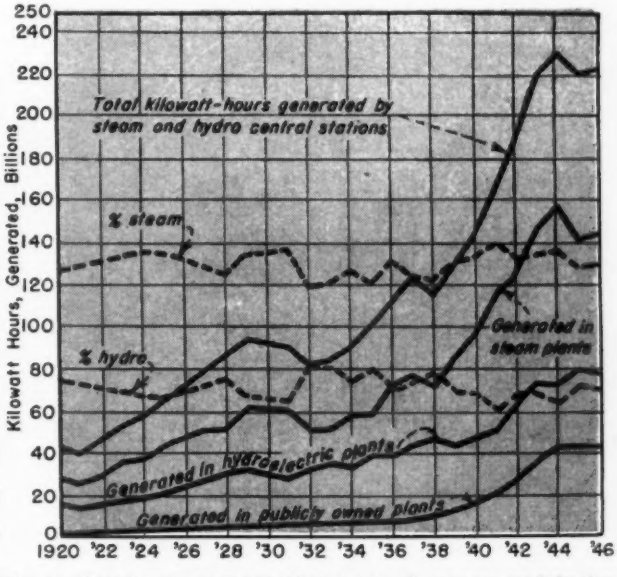

Kilowatt Hours, Generated, Billions
Total kilowatt-hours generated by steam and hydro central stations
% steam
% hydro
Generated in steam plants
Generated in hydroelectric plants
Generated in publicly owned plants
1920 '22 '24 '26 '28 '30 '32 '34 '36 '38 '40 '42 '44 '46

Fig. 2—Total power generated in U. S. steam and hydro central stations; kilowatt-hours supplied by each class of plant and the percent of the total each class generated

# Hydroelectric Projects Built or on Order

| Company or Government Agency | Design or Consulting Engineers | Project Name | New or Redeveloped | River | State or Territory | Date Project Started | Dam Type | Crest Length, Ft | Max Height, Ft | Date of Initial Operation | Initial Capacity, Kw | Date of Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NEW ENGLAND STATES** | | | | | | | | | | | | |
| Central Maine Power Co | | Union | Red. | | Me. | 1946 | .... | .... | ... | 1948 | 23,3 | ... |
| Bangor Hydro-Electric Co | | Milford No. 4A | Red. | Penobscot | Me. | 1948 | .... | .... | ... | 1949 | 2,6 | ... |
| Madison Electric Works | | | | | Me. | 1946 | .... | .... | ... | 1948 | 4 | ... |
| Bellows Falls Hydro-Elec Corp | Chas T Main, Inc | Wilder | Red. | Connecticut | N.H.&Vt. | 1947 | CG | .... | 59 | 1948 | 48,0 | ... |
| Public Service Co of New Hampshire | Nepsco Services, Inc | Berlin | New | Androscoggin | N.H. | 1946 | CG | 450 | 48 | 1947 | 20,5 | ... |
| Public Service Co of New Hampshire | | Franklin | | | N.H. | 1945 | .... | .... | ... | 1947 | | ... |
| Woodsville Water & Light Dept | | | | | N.H. | 1945 | .... | .... | ... | 1947 | | ... |
| Franklin Needle Co | | Franklin | Red. | | N.H. | 1946 | .... | .... | ... | 1947 | | ... |
| Franklin Needle Co | | Franklin | Red. | | N.H. | 1946 | .... | .... | ... | 1947 | | ... |
| Holyoke Water Power Co | | | Red. | | Mass. | 1945 | .... | .... | ... | 1946 | 4 | ... |
| Collins Manufacturing Co | | | Red. | | Mass. | 1945 | .... | .... | ... | 1946 | 4 | ... |
| Boott Mills | | | New | | Mass. | 1946 | .... | .... | ... | 1947 | | ... |
| Public Electric Light Co | Chas T Main, Inc | Woods Falls | New | Lamoille | Vt. | 1946 | CG | 525 | 52 | 1947 | 8,1 | ... |
| Morrisville Water & Light Dept | Chas T Main, Inc | Cady's Falls | Red. | Lamoille | Vt. | 1938 | CG | 300 | 25 | 1938 | 1,0 | {1 194 |
| Morrisville Water & Light Dept | Chas T Main, Inc | Green River Storage | New | Green | Vt. | 1946 | CA | 320 | 100 | 1947 | V | power at p |
| Commonwealth of Massachusetts | Metro Dist Water Supply Comm | Windsor Dam | New | Swift | Mass. | 1927 | Earth | 2,640 | 170 | 1946 | 1,7 | ... |
| Green Mountain Power Co | | Vergennes | Red. | | Vt. | 1945 | .... | .... | ... | 1946 | 1,4 | ... |
| Self-Locking Carton Co | | Palmer | Red. | | Mass. | 1946 | .... | .... | ... | 1946 | 3 | ... |
| Self-Locking Carton Co | | Palmer | Red. | | Mass. | 1946 | .... | .... | ... | 1946 | 3 | ... |
| American Woolen Co | | Beaver Brook | New | | Mass. | 1946 | .... | .... | ... | 1947 | 3 | ... |
| Village of Barton | | | New | | Vt. | 1946 | .... | .... | ... | 1948 | .... | ... |
| Brunswick Worsted Co | | Moosup | Red. | | Conn. | 1946 | .... | .... | ... | 1947 | 5 | ... |
| **MIDDLE ATLANTIC STATES** | | | | | | | | | | | | |
| Village of Booneville | | | New | | N.Y. | 1946 | .... | .... | ... | 1947 | 5 | ... |
| W. Va. Pulp & Paper Co | | Mechanicville | New | | N.Y. | 1946 | .... | .... | ... | 1947 | 8 | ... |
| **EAST NORTH CENTRAL STATES** | | | | | | | | | | | | |
| City of Sturgis | Ayres, Lewis, Norris & May | Sturgis | Red. | St. Joseph | Mich. | 1945 | CG | 330 | ... | .... | 1,3 | {1 194 |
| Presque Isle County Elec Co-op | | Rea Proj Mich 28 | New | | Mich. | 1946 | .... | .... | ... | .... | 1,8 | ... |
| The Wren Paper Co | | | Red. | | Ohio | 1945 | .... | .... | ... | 1946 | 1 | ... |
| City of Petoskey | | | Red. | | Mich. | 1945 | .... | .... | ... | 1946 | 1 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Erik Floor & Assoc | St. Mary's Falls | Red. | | Mich. | 1946 | .... | .... | ... | .... | 20,0 | ... |
| City of Kaukauna Elec & Wtr Dept | Mead, Ward & Hunt | Little Chute | New | | Wis. | 1946 | .... | .... | ... | .... | 4,9 | ... |
| City of Black River Falls | | | New | Black | Wis. | 1946 | .... | .... | ... | 1947 | 9 | ... |
| City of River Falls | | Upper | New | | Wis. | 1946 | .... | .... | ... | 1947 | 3 | ... |
| City of River Falls | | Lower | New | | Wis. | 1946 | .... | .... | ... | 1947 | 1 | ... |
| Oconto Electric Cooperative | | Stiles | New | Oconto | Wis. | 1946 | .... | .... | ... | 1948 | 1,5 | ... |
| John Strange Paper Co | | Menasha | Red. | | Wis. | 1945 | .... | .... | ... | 1946 | 2 | ... |
| Morgan County Farm Bureau Co-op | | McConnelsville | New | | Ohio | 1946 | .... | .... | ... | 1946 | 1 | ... |
| Beemster Electric Co | | Green Bay | Red. | | Wis. | 1946 | .... | .... | ... | 1947 | 1 | ... |
| Minnesota Power & Ltg Co | Ebasco Services, Inc | Thomson | Red. | St. Louis | Minn. | 1946 | .... | .... | ... | .... | | 1 194 |
| Croswell Light & Power Co | | Big Falls | | | Minn. | 1946 | .... | .... | ... | .... | | ... |
| Minnesota & Ontario Power Co | | International Falls | | | Minn. | 1945 | .... | .... | ... | 1947 | | ... |
| Consumers Public Power Dist | | | | | Neb.- | 1945 | .... | .... | ... | 1946 | | ... |
| General Mills, Inc | | C Mill | Red. | | Minn. | 1946 | .... | .... | ... | 1946 | | ... |
| Bowersock Mills & Power Co | | | Red. | | Kan. | 1946 | .... | .... | ... | 1947 | 3 | ... |
| **SOUTH ATLANTIC STATES** | | | | | | | | | | | | |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Sanderson & Porter | Allatoona | New | Etowah | Ga. | 1946 | CG | 1,325 | 200 | 1949 | 102,9 | ... |
| Wadley Veneer & Basket Co | | Wadley | Red. | | Ga. | 1946 | .... | .... | ... | 1946 | | ... |
| Randolph Mills | | Franklinville | Red. | | N.C. | 1946 | .... | .... | ... | 1947 | 5 | ... |
| Mechlenberg Milling Co | | South Hill | Red. | | Va. | 1946 | .... | .... | ... | 1947 | 1 | ... |
| Harden Manufacturing Co | | Gastonia | Red. | | N.C. | 1946 | .... | .... | ... | 1947 | 1 | ... |
| City Mills Co | | Columbus | New | | Ga. | 1946 | .... | .... | ... | 1947 | 3 | ... |
| Blanche Cotton Mills | | Augusta | New | | Ga. | 1945 | .... | .... | ... | 1947 | 4 | ... |
| Habersham Mills | | Habersham | Red. | | Ga. | 1945 | .... | .... | ... | 1946 | 1,6 | ... |
| **EAST SOUTH CENTRAL STATES** | | | | | | | | | | | | |
| Tennessee Valley Authority | Tennessee Valley Authority | Kentucky | New | Tennessee | Ky. | 1938 | CGE | 8,412 | 206 | 1944 | 176,0 | {1 194 |
| Tennessee Valley Authority | Tennessee Valley Authority | Wheeler | New | Tennessee | Ala. | 1933 | CGE | 6,335 | 68 | 1936 | 90,0 | {2 194 |
| Tennessee Valley Authority | Tennessee Valley Authority | Fort Loudoun | New | Tennessee | Tenn. | 1940 | CGE | 4,196 | 122 | 1943 | 88,0 | {2 194 |
| Tennessee Valley Authority | Tennessee Valley Authority | Douglas | New | French Broad | Tenn. | 1942 | C&E | 1,705 | 202 | 1943 | 83,0 | {1 194 |
| Tennessee Valley Authority | Tennessee Valley Authority | South Holston | New | South Holston | Tenn. | 1942 | R&E | 1,505 | 290 | .... | 41,5 | ... |
| Tennessee Valley Authority | Tennessee Valley Authority | Watauga | New | Watauga | Tenn. | 1942 | R&E | 900 | 318 | 1949 | 69,0 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Chas T Main, Inc | Dale Hollow | New | Obey | Tenn. | 1942 | CG | 1,717 | 200 | 1947 | 50,0 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Chas T Main, Inc | Center Hill | New | Carney Fork | Tenn. | 1942 | C&E | 2,160 | 240 | 1948 | 138,0 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Chas T Main, Inc | Wolf Creek | New | Cumberland | Ky. | 1942 | C&E | 5,700 | 240 | 1949 | 207,0 | ... |
| Alabama Electric Cooperative | | Andalusia | New | | Ala. - | 1946 | .... | .... | ... | 1948 | .... | ... |
| **WEST SOUTH CENTRAL STATES** | | | | | | | | | | | | |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Fargo Engineering Co | Fort Gibson | New | Grand | Okla. | 1946 | CGE | 2,850 | 110 | .... | 80,0 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps<br>L H Harza Engineering Co | Norfolk Dam | New | North Fork | Ark. | 1940 | CG | 2,631 | 233 | 1944 | 42,0 | {1 194 |
| U. S. Engineer Corps | U. S. Engineer Corps<br>Fargo Engineering Co | Narrows Dam | New | Little Missouri | Ark. | .... | CG | 941 | 191 | .... | 24,0 | ... |
| U. S. Engineer Corps | U. S. Engineer Corps | Dennison Dam | New | Red | Texas & Okla. | 1939 | EF | 23,200 | 165 | 1945 | 59,0 | {1 194 |
| **MOUNTAIN STATES** | | | | | | | | | | | | |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Anderson Ranch | New | Boise | Idaho | 1941 | EF | 1,350 | 330 | 1949 | 37,0 | ... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Davis Dam | New | Colorado | Ariz. & Nev. | 1941 | R&E | 1,600 | 135 | 1950 | 311,0 | ... |

Compiled by P. A. Annett, Associate Editor

"New" appears to indicate that the project is one that has not been developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, generators and settings, or a new plant.

²CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; EF, earth fill; R&E, rock and earth

CGE, concrete gravity and earth fill; CGG, concrete gravity with gates.

³AC —Allis-Chalmers Mfg Co
BL —Baldwin Locomotive Works
JL —James Leffel & Co
MS —S Morgan Smith Co

PW —Pelton Water Wheel Co
W —Woodward Governor Co
L —Lombard Governor Co
CAC —Canadian Allis-Chalmers, Ltd
CBS —Charles Barber & Sons

# n the United States and Canada in 1946

| Year of Addition | Year of Initial Op. | Ultimate Capacity, Hp | No. of Units Installed | Waterwheel Capacity, Hp | Waterwheel Type | Speed, RPM | Static Head, Ft | Design Head, Ft | Waterwheel Manufacturer | Governor Manufacturer | Head Gate, Controlled or Only | Headwater Valve, Type | Generator Capacity, Kva | Synchronous, Induction or Manual | Thrust-Bearing Position | Design Power Factor | Kv | Cycles | Generator Manufacturer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ... | .... | 23,200 | 2 | 11,600 | Kaplan | 225 | 76 | 76 | MS | W | Concrete | Head gt | 12,000 | ..... | AG | 0.70 | 6.9 | 60 | GE |
| ... | .... | 2,600 | 1 | 2,600 | Kaplan | 120 | 20 | 20 | MS | .. | Concrete | Head gt | 2,000 | Automatic | AG | 0.80 | 4.16 | 60 | GE |
| ... | .... | ..... | 1 | 406 | Kaplan | 240 | 16 | 16 | MS | .. | Concrete | Head gt | ..... | ..... | .... | .... | .... | .. | ..... |
| ... | .... | 48,000 | 2 | 24,000 | Kaplan | 112.5 | 53 | 49 | MS | .. | Concrete | Head gt | 18,000 | Manual | BG | 0.90 | 13.8 | 60 | AC |
| ... | .... | 20,500 | 1 | 20,500 | Francis | 128.6 | 88 | 83 | BL | W | Plate st. | Head gt | 18,750 | Automatic | BG | 0.80 | 6.9 | 60 | GE |
| ... | .... | ..... | 1 | ..... | ..... | 200 | ..... | ... | .... | .. | ..... | | 7,500 | ..... | BG | 0.80 | 4.16 | 60 | GE |
| ... | .... | ..... | 1 | 595 | ..... | 180 | 14 | 14 | .... | W | Concrete | Head gt | 500 | Manual | AG | 0.80 | 2.4 | 60 | GE |
| ... | .... | ..... | 1 | 76 | Francis | 750 | 35 | 35 | MS | W | ..... | Head gt | Reconstructed unit | | ... | .... | .... | .. | ..... |
| ... | .... | ..... | 1 | 49 | Francis | 750 | 35 | 35 | MS | W | ..... | Head gt | Reconstructed unit | | ... | .... | .... | .. | ..... |
| ... | .... | 420 | 1 | 420 | Propeller | 225 | 19 | 19 | JL | .. | ..... | Drives existing generator | | | ... | .... | .... | .. | GE |
| ... | .... | 460 | 2 | 230 | Propeller | 225 | 14 | 14 | JL | .. | ..... | Drives existing generator | | | .... | .... | .... | .. | GE |
| ... | .... | ..... | 3 | 520 | Francis | 200 | 20 | 20 | JL | .. | Concrete | Head gt | 375 | Manual | AG | 0.80 | 0.6 | 60 | GE |
| ... | .... | 8,100 | 1 | 8,100 | Kaplan | 200 | 55 | 55 | MS | W | Concrete | Head gt | 6,250 | Automatic | AG | 0.80 | 4.16 | 60 | GE |
| | | 2,080 | 1 | 1,040 | Francis | 277 | 37–46 | 42 | JL | W | Concrete | Head gt | 1,000 | Manual | HS | 0.70 | 2.4 | 60 | WE |
| {1 | 1947 | | 1 | 1,040 | Kaplan | 400 | 37–46 | 42 | MS | W | Concrete | Head gt | 1,000 | Manual | AG | 0.70 | 2.4 | 60 | WE |
| power at present, a 17,500 a re-ft storage project for plants on Lameille River. Provisions made to install a 1,250-hp unit when needed. | | | | | | | | | | | | | | | | | | | |
| ... | .... | 1,700 | 1 | 1,700 | Francis | 600 | 155 | 140 | MS | W | Cast iron | Head gt | 1,500 | Automatic | AG | 0.80 | 2.4 | 60 | EM |
| ... | .... | ..... | 1 | 1,400 | Francis | 257 | 35 | 35 | JL | .. | Concrete | Head gt | Drives existing generator | | .... | .... | .. | | WE |
| ... | .... | ..... | 1 | 300 | Francis | 327 | 21 | 21 | JL | W | Concrete | Head gt | Drives existing generator | | ..... | .... | .. | | WE |
| ... | .... | ..... | 1 | 165 | Francis | 300 | 18 | 18 | JL | W | Concrete | Head gt | Drives existing generator | | .... | .... | .. | | WE |
| ... | .... | 274 | 1 | 274 | Francis | 277 | 26 | 26 | JL | .. | Concrete | Head gt | ..... | ..... | .... | .... | .. | | GE |
| ... | .... | ..... | 1 | ..... | ..... | 360 | ..... | ... | .... | .. | ..... | ..... | 875 | Manual | AG | 0.80 | 2.4 | 60 | GE |
| ... | .... | 300 | 1 | 300 | ..... | 600 | 15 | 15 | .... | W | ..... | Head gt | 250 | Manual | HS | 0.60 | 0.6 | 60 | WE |
| ... | .... | 350 | 1 | 350 | Francis | 327 | 22 | 22 | JL | W | Concrete | Head gt | 250 | Manual | HS | 0.80 | 2.4 | 60 | GE |
| ... | .... | 893 | 1 | 893 | Propeller | 250 | 23 | 23 | MS | W | Concrete | Head gt | 625 | Manual | AG | 0.80 | 0.48 | 25 | GE |
| | | 2,980 | 2 | 690 | Francis | 150 | 26 | 26 | .... | .. | Concrete | Head gt | 500 | Manual | AG | 0.80 | 2.4 | 60 | ..... |
| {1 | 1947 | ..... | 1 | 1,500 | Francis | 112.5 | 26 | 26 | JL | W | Concrete | Head gt | 1,500 | Manual | AG | 0.80 | 2.4 | 60 | AC |
| ... | .... | 1,800 | 2 | 900 | Kaplan | 450 | 42 | 42 | MS | W | Concrete | Head gt | 750 | Manual | AG | 0.80 | 2.4 | 60 | WE |
| ... | .... | 160 | 1 | 160 | Francis | 94 | 19 | 19 | JL | .. | ..... | Drives existing generator | | | ... | .... | .... | .. | ..... |
| ... | .... | 186 | 2 | 93 | Francis | 360 | 20 | 20 | JL | .. | ..... | Drives existing generator | | | ... | .... | .... | .. | EM |
| ... | .... | 20,925 | 3 | 6,975 | Propeller | 80 | 21 | 21 | AC | .. | Concrete | Head gt | ..... | ..... | ... | .... | .... | .. | GE |
| ... | .... | 4,980 | 3 | 1,660 | Kaplan | 112.5 | 14 | 14 | MS | W | Concrete | Head gt | ..... | ..... | ... | .... | .... | .. | ..... |
| ... | .... | 925 | 1 | 925 | Francis | 138.5 | 22 | 22 | JL | W | Concrete | Head gt | 750 | Manual | AG | 0.80 | 2.4 | 60 | WE |
| ... | .... | 330 | 1 | 330 | Francis | 450 | 42 | 42 | JL | W | Concrete | Head gt | 312 | Manual | AG | 0.80 | 2.3 | 60 | GE |
| ... | .... | 180 | 1 | 180 | Francis | 240 | 20 | 20 | JL | W | Concrete | Head gt | 156 | Manual | AG | 0.80 | 2.3 | 60 | GE |
| ... | .... | 1,500 | 2 | 750 | Kaplan | 225 | 20 | 20 | MS | W | Concrete | Head gt | ..... | ..... | ... | .... | .... | .. | AC |
| ... | .... | 162 | 3 | 54 | Francis | 93 | 7 | 7 | JL | .. | ..... | Head gt | Drives mill machinery | | .... | .... | .. | | ..... |
| ... | .... | 169 | 1 | 169 | Francis | 150 | 14 | 14 | JL | .. | Concrete | Head gt | Drives mill machinery | | .... | .... | .. | | ..... |
| ... | .... | 107 | 1 | 107 | Propeller | 200 | 9 | 9 | JL | .. | ..... | Drives existing generator | | | ..... | .... | .. | | ..... |
| 1 | 1949 | 89,000 | 1 | 20,000 | Francis | 400 | 355 | 355 | MS | W | Plate st | Head gt | 15,000 | Manual | AG | 0.80 | 6.9 | 60 | GE |
| ... | .... | ..... | 1 | 580 | Francis | 277 | 35 | 35 | JL | W | Concrete | Head gt | 500 | Manual | AG | 0.80 | 2.4 | 60 | GE |
| ... | .... | ..... | 1 | 2,500 | Francis | 225 | 29 | 29 | MS | .. | Concrete | Head gt | Drives pulpwood grinders | | | .... | .. | | ..... |
| ... | .... | ..... | 1 | 350 | Propeller | 225 | 13 | 13 | JL | .. | ..... | Head gt | Drives existing ac generator | | | .... | .. | | WE |
| ... | .... | ..... | 2 | 1,010 | Francis | 220 | 48 | 48 | JL | .. | Concrete | Head gt | Drives mill machinery | | .... | .... | .. | | ..... |
| ... | .... | ..... | 1 | 320 | Francis | 120 | 14 | 14 | JL | .. | ..... | Head gt | Drives existing ac generators | | | .... | .. | | GE |
| ... | .... | 152,900 | 2 | 50,000 | Francis | 112.5 | 153–105 | 135 | MS | W | Plate st | Head gt | 40,000 | ..... | BG | 0.90 | 13.8 | 60 | WE |
| | | | 1 | 2,900 | Francis | 450 | 153–105 | 135 | JL | W | Service unit | | 2,500 | ..... | AG | 0.80 | 2.4 | 60 | WE |
| ... | .... | ..... | 1 | ..... | ..... | 1200 | ..... | ... | .... | .. | ..... | ..... | 18.7 | Manual | HS | 0.80 | 0.24 | 60 | WE |
| ... | .... | 520 | 1 | 520 | Francis | 200 | 27 | 27 | JL | .. | ..... | Head gt | Drives existing ac generator | | | .... | .. | | ..... |
| ... | .... | 143 | 1 | 143 | Francis | 180 | 26 | 26 | JL | .. | ..... | Head gt | Drives existing ac generator | | | .... | .. | | ..... |
| ... | .... | 316 | 1 | 320 | Francis | 120 | 12 | 12 | JL | .. | ..... | Head gt | Drives existing ac generator | | | .... | .. | | ..... |
| ... | .... | 510 | 3 | 170 | Francis | 125 | 12 | 12 | JL | .. | ..... | Head gt | ..... | ..... | ... | .... | .... | .. | WE |
| ... | .... | 463 | 1 | 463 | ..... | 150 | 13 | 13 | .... | W | Concrete | Head gt | 375 | Manual | AG | 0.80 | 0.6 | 60 | GE |
| ... | .... | 1,680 | 2 | 840 | Francis | 514 | 85 | 85 | MS | .. | Concrete | Head gt | Reconstructed unit | | | .... | .... | .. | ..... |
| | | 220,000 | 4 | 44,000 | Kaplan | 78.3 | 57–20 | 48 | AC | AC | Concrete | Head gt | 35,000 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| {1 | 1947 | | 1 | 44,000 | Kaplan | 78.3 | 57–20 | 48 | AC | AC | Concrete | Head gt | 35,000 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| | | | 2 | 45,000 | Propeller | 85.7 | 54–43 | 48 | BL | W | Concrete | Head gt | 36,000 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| {2 | 1941 | 360,000 | 2 | 45,000 | Propeller | 85.7 | 54–43 | 48 | BL | W | Concrete | Head gt | 36,000 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| {2 | 1948 | | 2 | 45,000 | Propeller | 85.7 | 54–43 | 48 | BL | W | Concrete | Head gt | 36,000 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| | | 176,000 | 2 | 44,000 | Kaplan | 105.8 | 78–60 | 65 | BL | W | Concrete | Head gt | 35,500 | Manual | BG | 0.90 | 13.8 | 60 | AC |
| {2 | 1948 | | 2 | 44,000 | Kaplan | 105.8 | 78–60 | 65 | BL | W | Concrete | Head gt | 35,500 | Manual | BG | 0.90 | 13.8 | 60 | AC |
| | | 166,000 | 2 | 41,500 | Francis | 94.7 | 129–47 | 100 | MS | W | Concrete | Head gt | 33,333 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| {1 | 1948 | | 1 | 25,500 | Francis | 90 | 95–47 | 100 | MS | W | Concrete | Head gt | 28,888 | Manual | BG | 0.90 | 13.8 | 60 | GE |
| ... | .... | 41,500 | 1 | 41,500 | Francis | ..... | 252–126 | 180 | .... | .. | ..... | ..... | 35,000 | Manual | BG | 0.90 | 13.8 | 60 | ..... |
| ... | .... | 69,000 | 2 | 34,500 | Francis | 200 | ..... | 216 | NN | W | ..... | Head gt | 27,777 | Manual | BG | 0.90 | 13.8 | 60 | WE |
| ... | .... | 75,000 | 2 | 25,000 | Francis | 163.6 | 118–115 | 140 | MS | W | Plate st | Head gt | 20,000 | ..... | BG | 0.90 | 13.2 | 60 | WE |
| | | | 1 | 1,305 | Francis | 720 | 118–115 | 140 | JL | W | Service unit | | 1,000 | ..... | AG | 0.80 | 2.4 | 60 | WE |
| ... | .... | 207,000 | 2 | 69,000 | Francis | 105.9 | 206–134 | 160 | .... | .. | Plate st | Head gt | 50,000 | ..... | ... | 0.90 | 13.8 | 60 | GE |
| ... | .... | 414,000 | 3 | 69,000 | Francis | 105.9 | 214–111 | 160 | .... | .. | Plate st | Head gt | 50,000 | ..... | ... | 0.90 | 13.8 | 60 | GE |
| ... | .... | ..... | 1 | ..... | ..... | 138.5 | .. .. | ... | .... | .. | ..... | ..... | 2,500 | ..... | AG | 0.80 | 2.3 | 60 | GE |
| ... | .... | 120,000 | 4 | 30,000 | Francis | 100 | 63 | 61 | .... | . | Concrete | Head gt | 13,666 | ..... | BG | 0.90 | 13.8 | 60 | ..... |
| | | | 1 | 42,000 | Francis | 128.5 | 202–132 | 160 | MS | W | Plate st | Head gt | 38,889 | ..... | BG | 0.90 | 13.8 | 60 | WE |
| | | 168,000 | 1 | 540 | Francis | 720 | 202–132 | 160 | JL | W | Service unit | | 500 | ..... | AG | 0.80 | 0.48 | 60 | WE |
| {1 | 1948 | | 1 | 42,000 | Francis | 128.5 | 202–132 | 160 | MS | W | Plate st | Head gt | 38,889 | ..... | BG | 0.90 | 13.8 | 60 | WE |
| ... | ... | 30,000 | 2 | 12,000 | Francis | 225 | 159–100 | 132 | .... | .. | Plate st | Head gt | 9,444 | ..... | ... | 0.90 | 13.8 | 60 | ..... |
| | | | 1 | 56,000 | Francis | 90 | 113–75 | 103 | MS | W | Plate st | ..... | 43,000 | ..... | BG | 0.95 | 13.8 | 60 | WE |
| | | 283,080 | 2 | 1,540 | Francis | ... | 113–75 | 103 | JL | W | Service unit | | 750* | ..... | AG | 0.80 | 0.48 | 60 | WE |
| {1 | 1947 | | 1 | 56,000 | Francis | 90 | 113–75 | 103 | MS | W | Plate st | ..... | 43,000 | ..... | BG | 0.95 | 13.8 | 60 | WE |
| ... | .... | 55,500 | 2 | 18,500 | Francis | 277 | 330–173 | 260 | JL | W | Cast st | Butterfly | 15,000 | Manual | AG | 0.90 | 6.9 | 60 | WE |
| ... | .... | 311,000 | 5 | 62,200 | Francis | 94.7 | 147–100 | 127 | BL | .. | Plate st | Head gt | 45,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | GE |

MC —Dominion Engineering Works, Ltd
MG —S Morgan Smith Canada, Ltd
MSI —S Morgan Smith-Inglis, Ltd
VEW—Vancouver Engineering Works, Ltd
EC —Elliott Co
EM —Electric Machinery Mfg Co

WE —Westinghouse Electric Corp
CGE —Canadian General Electric Co, Ltd
CWC—Canadian Westinghouse Co, Ltd
EEC —English Electric Co of Canada, Ltd
OC —Oerlikon, Canada, Ltd

AG indicates that the thrust bearing is above generator; BG, thrust bearing is below the generator; HS, horizontal-shaft machine.
* Units installed in 1923, rated 25,000 hp, have been rebuilt for 44,000 hp.

# Hydroelectric Projects Built or on Order

Compiled by F A Annett, Associate Editor

| Company or Government Agency | Design or Consulting Engineers | Project Name | New or Redeveloped | River | State or Province | Date Project Started | Dam, Type | Dam, Length, Ft | Dam, Height, Ft | Date of Initial Operation | Ultimate Installed Capacity, Kw | Power Units, Number and Date of Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOUNTAIN STATES** — *Continued* | | | | | | | | | | | | |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Estes | New | Big Thompson | Colo. | 1947 | .... | .... | ... | 1949 | 63,000 | .. .... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Mary's Lake | New | Big Thompson | Colo. | 1947 | .... | .... | ... | 1949 | 11,300 | .. .... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Kortes | New | North Platte | Wyo. | 1946 | CG | .... | 230 | 1949 | 55,500 | .. .... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Heart Mt | New | Shoshone | Wyo. | 1946 | .... | .... | ... | 1949 | 8,300 | .. .... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Boysen | New | Big Horn | Wyo. | 1947 | EF | 1,000 | 150 | 1950 | 21,000 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Upper Salmon | New | Snake | Idaho | 1945 | CG | 3,300 | 14 | 1947 | 23,000 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Lower Salmon | New | Snake | Idaho | 1946 | CG | .... | ... | 1948 | 85,800 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Upper Malad | New | Malad | Idaho | 1946 | .... | .... | ... | 1948 | 12,000 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Lower Malad | Red. | Malad | Idaho | 1946 | .... | .... | ... | 1949 | 22,000 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Swan Falls | Red. | Snake | Idaho | 1945 | .... | .... | ... | 1946 | 3,230 | .. .... |
| Idaho Power Co | Ebasco Services, Inc | Horseshoe Bend | Red. | Payette | Idaho | 1945 | .... | .... | ... | 1946 | 3,000 | .. .... |
| Montana Power Co | Ebasco Services, Inc | Kerr | New | Flathead | Mont. | 1930 | CA | 385 | 200 | 1938 | 77,000 | 1 1949 |
| U. S. Engineer Corps | U. S. Engineer Corps; Harza Engineering Co | Fort Peck | New | Missouri | Mont. | 1934 | HEF | 21,000 | 250 | 1943 | 50,000 | 1 1947 |
| Montana Light & Power Co | | Troy | New | | Mont. | 1946 | .... | .... | ... | 1948 | .... | .. .... |
| City of Longmont | | Longmont | New | | Colo. | 1946 | .... | .... | ... | 1947 | .... | .. .... |
| Cooke Light & Power Co | | Cooke | New | | Mont. | 1946 | .... | .... | ... | 1947 | .... | .. .... |
| Monroe City Corp | | Monroe | New | | Utah | 1946 | .... | .... | ... | 1947 | .... | .. .... |
| **PACIFIC COAST STATES** | | | | | | | | | | | | |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Grand Coulee | New | Columbia | Wash. | 1934 | CG | 4,500 | 553 | 1941 | 478,000 | 3 1943-4<br>3 1947-8 |
| City of Eugene | | Leaburg | New | McKenzie | Ore. | 1927 | Roller | 330 | 20 | 1929 | 10,000 | 3 1949<br>1 1949 |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Shasta | New | Sacramento | Calif. | 1928 | CG | 3,500 | 560 | 1944 | 213,000 | 2 1947<br>1 1948 |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Keswick | New | Sacramento | Calif. | 1941 | CG | 1,050 | 120 | 1949 | 102,000 | .. .... |
| Pacific Power & Light Co | | Deschutes | .... | Crooked | Ore. | .... | Rock | .... | .... | .... | 2,200 | .. .... |
| U. S. Bureau of Reclamation | U. S. Bureau of Reclamation | Deschutes | New | Unit installed by U.S. B.R. in Pacific Power & Lt Co's plant (above) | | | | | | | | 1 1946 |
| Southern California Edison Co | Stone & Webster Co; Southern Calif. Edison Co | Big Creek No. 3 | New | San Joaquin | Calif. | 1921 | CA | 494 | 130 | 1923 | 105,000 | 1 1948 |
| Pacific Gas & Electric Co | Pacific Gas & Elec Co | West Point | New | Mokelumne | Calif. | 1947 | CA | 420 | 100 | .... | 17,000 | .. .... |
| Pacific Gas & Electric Co | Pacific Gas & Elec Co | Electra | Red. | Mokelumne | Calif. | 1947 | Earth | 640 | 120 | 1948 | 112,500 | .. .... |
| **CANADA** | | | | | | | | | | | | |
| Avon River Power Co | Montreal Engrg Co Ltd | Methols | New | Methols | N.S. | 1947 | EF | 1,000 | 50 | 1948 | 4,600 | .. .... |
| Nova Scotia Power Comm | | Dickey Brook | New | | N.S. | 1946 | .... | .... | ... | 1947 | 1,400 | .. .... |
| Town of Berwick | | Berwick | Red. | Factorydale | N.S. | 1945 | CG | .... | ... | 1946 | .... | .. .... |
| Quebec Hydro-Electric Comm; Beauharnois Lt Ht & Pr Co | | Beauharnois | New | St. Lawrence | Que. | 1929 | P&G | 4,500 | 31 | 1932 | 440,000 | 1 1939<br>2 1940<br>2 1941<br>1 1947 |
| Shawinigan Water & Power Co | Shawinigan Engrg Co | Shawinigan No. 3 | New | St. Maurice | Que. | 1946 | .... | .... | ... | 1948 | 195,000 | .. .... |
| Gatineau Power Co | Shawinigan Engrg Co | Farmers Rapids | New | Gatineau | Que. | 1926 | RE | 3,600 | 56 | 1927 | 96,000 | 1 1947 |
| Canadian International Paper Co | | Pentecote | New | | Que. | 1945 | .... | .... | ... | 1946 | .... | 1 .... |
| Lower St. Lawrence Power Co | Foundation Co of Canada | Lower Metis | New | Metis | Que. | 1945 | CG | 75 | 77 | 1947 | 6,000 | .. .... |
| Rolland Paper Co | | | New | | Que. | 1946 | .... | .... | ... | 1947 | .... | .. .... |
| Hydro-Elec Power Comm of Ont | Hydro-Elec Power Comm of Ont | Decew Falls Ext | New | Welland Canal | Ont. | 1941 | None | .... | ... | 1943 | 72,000 | 1 1947 |
| Hydro Elec Power Comm of Ont | Hydro-Elec Power Comm of Ont | Stewartville | New | Madawaska | Ont. | 1945 | CG | 1,300 | 200 | 1948 | 56,000 | .. .... |
| Hydro-Elec Power Comm of Ont | Hydro-Elec Power Comm of Ont | Ear Falls | New | English | Ont. | 1936 | CG | 60 | 46 | 1937 | 10,000 | 1 1940<br>1 1948 |
| Hydro-Elec Power Comm of Ont | Hydro-Elec Power Comm of Ont | Des Joachims | New | Ottawa | Ont. | 1947 | CG | 5,500 | 165 | 1950 | 372,000 | .. .... |
| Hydro-Elec Power Comm of Ont | Hydro-Elec Power Comm of Ont | Aguasabon | New | Aguasabon | Ont. | 1946 | CG | 950 | 110 | 1948 | 55,000 | .. .... |
| Gananoque Elec Lt & Wtr Supply Co | H G Acres & Co | Jones Falls | New | Rideau Canal | Ont. | 1946 | .... | .... | ... | 1947 | 1,300 | .. .... |
| Town of Bracebridge | H G Acres & Co | High Falls | New | Muskoka | Ont. | 1946 | CG | 230 | 20 | 1947 | 1,200 | .. .... |
| Kalamazoo Vegetable Parchment Co | H G Acres & Co | Espanola | Red. | Spanish | Ont. | 1944 | .... | .... | ... | 1946 | 10,000 | .. .... |
| City of Winnipeg | Winnipeg Engrg Dept | Slave Falls | New | Winnipeg | Man. | 1929 | .... | .... | ... | 1931 | 24,000 | 1 1937<br>1 1938<br>2 1946<br>2 1947 |
| Churchill River Power & Lt Co | | Island Falls | New | Churchill | Sask. | 1936 | .... | .... | ... | .... | 57,000 | 1 1937<br>1 1939<br>1 1948 |
| Canada's Dept of Mines & Resources | Montreal Engrg Co | Snare River | New | Snare | N.W.T. | 1946 | EF | 900 | 65 | 1948 | 8,400 | .. .... |
| Calgary Power Co | Montreal Engrg Co | Barrier | New | Kananaskis | Alt. | 1945 | EF | 1,800 | 150 | 1947 | 13,500 | .. .... |
| Bridge River Power Co | Shawinigan Engrg Co; B. C. Elec Co Engrg Staff | Bridge River | New | Bridge | B.C. | 1946 | EF | 1,000 | 60 | .... | 62,000 | .. .... |
| Powell River Co | W B Scoular | Lois River | New | Lois | B.C. | 1929 | CA | 640 | 170 | 1931 | 24,000 | 1 1947 |
| British Columbia Power Comm | H G Acres Co | Campbell River | New | Campbell | B.C | 1945 | CG | 2,900 | 140 | 1947 | 56,000 | .. .... |
| British Columbia Power Comm | H G Acres Co | Ladore Falls | New | Campbell | B.C. | 1946 | CG | 310 | 106 | 1948 | To use 5,000 acre-ft | .. .... |
| B. C. Pulp & Paper Co | | | New | | B.C. | 1945 | .... | .... | ... | 1947 | 3,600 | .. .... |
| Electric Power Equipment, Ltd | | | New | | B.C. | 1945 | .... | .... | ... | 1946 | .... | .. .... |

'The term "New" applied to an entirely new project on a site that has not been developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, generators and settings, or a new plant.

²CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; EF, earth fill; R&E, rock and earth fill; HEF, hydraulic earth fill; CGG, concrete gravity with gates.

³AC —Allis-Chalmers Mfg Co
BL —Baldwin Locomotive Works
JL —James Leffel & Co
MS —S Morgan Smith Co
PW —Pelton Water Wheel Co
W —Woodward Governor Co
L —Lombard Governor Co
⁴CAC —Canadian Allis-Chalmers, Ltd
⁵CBS —Charles Bunker & Sons

# n the United States and Canada in 1946

| No. of Units | Date of Unit(s) Op. | Ultimate Capacity, Hp | No. of Units Installed | Waterwheel Capacity, Hp | Waterwheel Type | Speed, RPM | Static Head, Feet | Design Head, Feet | Waterwheel Manufacturer | Governor Manufacturer | Scroll Case, Concrete or Steel | Pressure Valve, Type | Generator Capacity, Kva | Synchronizing, Automatic or Manual | Thrust-Bearing Location | Design Power Factor | Kilovolts | Cycles | Generator Manufacturer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .. | .... | 63,000 | 3 | 21,000 | Francis | 400 | 563–550 | 515 | AC | .. | Plate st | Butterfly | 16,667 | Auto or man. | AG | 0.90 | 6.9 | 60 | GE |
| .. | .... | 11,300 | 1 | 11,300 | Francis | 327 | 217–207 | 212 | NN | .. | Plate st | Head gt | 9,000 | Automatic | AG | 0.90 | 6.9 | 60 | GE |
| .. | .... | 55,800 | 3 | 18,500 | Francis | 240 | 209–158 | 200 | AC | AC | Plate st | Ring | 13,333 | Auto or man. | AG | 0.90 | 6.9 | 60 | ..... |
| .. | .... | 8,300 | 1 | 8,300 | Francis | 450 | 277 | 265 | MS | W | Plate st | Head gt | 6,000 | Auto or man. | AG | 0.83 | 2.4 | 60 | EC |
| .. | .... | 21,000 | 2 | 10,500 | Francis | 180 | 112–70 | 96 | .... | .. | ..... | ..... | 7,500 | Manual | AG | 1.00 | 6.9 | 60 | ..... |
| .. | .... | 23,000 | 2 | 11,500 | Propeller | 112.5 | 35 | 35 | BL | W | Concrete | Head gt | 9,000 | Manual | BG | 0.82 | 6.9 | 60 | GE |
| | | | 3 | 21,000 | Propeller | 120 | 55.5 | 55.5 | NN | W | Concrete | Head gt | 19,800 | Manual | AG | 0.86 | 13.8 | 60 | AC |
| .. | .... | 85,800 | 1 | 22,800 | Kaplan | 120 | 55.5 | 55.5 | MS | W | Concrete | Head gt | 19,800 | Manual | AG | 0.86 | 13.8 | 60 | AC |
| .. | .... | 12,000 | 1 | 12,000 | Francis | 225 | 124 | 124 | AC | W | Plate st | Head gt | 8,400 | Automatic | AG | 0.86 | 6.9 | 60 | AC |
| .. | .... | 22,000 | 1 | 22,000 | Francis | 200 | 157 | 157 | AC | W | Plate st | Head gt | 15,500 | Automatic | AG | 0.86 | 13.8 | 60 | AC |
| .. | .... | 3,200 | 2 | 1,600 | Francis | 129 | 23 | 23 | JL | .. | Concrete | Head gt | Drives existing generator | | | | .... | .. | ..... |
| .. | .... | 3,090 | 3 | 1,030 | Francis | 125 | 35 | 35 | JL | W | Concrete | Head gt | Drives existing generator | | | | .... | .. | ..... |
| | .... | 154,000 | 1 | 77,000 | Francis | 112.5 | 191 | 189 | NN | W | Plate st | Head gt | 56,000 | Manual | BG | 0.90 | 13.8 | 60 | WE |
| 1 | 1949 | | 1 | 77,000 | Francis | 112.5 | 191 | 189 | NN | W | Plate st | Head gt | 56,000 | Manual | BG | 0.90 | 13.8 | 60 | WE |
| | .... | 150,000 | 1 | 50,000 | Francis | 128.5 | 205–120 | 170 | MS | W | Plate st | Butterfly | 38,889 | Manual | BG | 0.90 | 13.8 | 60 | AC |
| 1 | 1947 | | 1 | 20,000 | Francis | 164 | 205–120 | 140 | MS | W | Plate st | Butterfly | 16,667 | Manual | BG | 0.90 | 13.8 | 60 | AC |
| .. | .... | ..... | 1 | 5,280 | Francis | 360 | 150 | 150 | MS | .. | Plate st | Head gt | 4,375 | Manual | AG | 0.80 | 2.4 | 60 | GE |
| .. | .... | ..... | 1 | 1,240 | Francis | 1,200 | 523 | 523 | JL | .. | Cast st | ..... | 1,125 | Manual | HS | 0.80 | 2.4 | 60 | GE |
| .. | .... | ..... | 1 | 150 | Francis | 1,200 | 120 | 120 | JL | .. | Cast st | Head gt | 125 | Manual | HS | 0.80 | 2.4 | 60 | GE |
| .. | .... | ..... | 1 | ..... | ..... | 1,200 | ..... | ... | .... | .. | ..... | Head gt | 156 | Manual | HS | 0.80 | 2.4 | 60 | WE |
| | | | 3 | 150,000 | Francis | 120 | 368 | 300 | NN | W | Cast st | Head gt | 108,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | WE |
| .. | ..... | | 2 | 14,000 | Francis | 400 | 368 | 335 | PW | W | Service units | | 12,500 | Auto or man. | AG | 0.80 | 2.4 | 60 | WE |
| 3 | 1943–4 | 2,877,000 | 3 | 150,000 | Francis | 120 | 368 | 300 | NN | W | Cast st | Head gt | 108,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | WE |
| 3 | 1947–8 | | 3 | 150,000 | Francis | 120 | 368 | 300 | NN | W | Cast st | Head gt | 108,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | WE |
| 3 | 1949 | | 3 | 165,000 | Francis | 120 | 368 | 300 | NN | W | Cast st | Head gt | 120,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | WE |
| | .... | 20,000 | 1 | 10,000 | Francis | 225 | 89–80 | 88 | MS | MS | Concrete | Head gt | 7,500 | Manual | AG | 1.00 | 11.5 | 60 | WE |
| 1 | 1949 | | 1 | 10,000 | Francis | 225 | 89–80 | 88 | MS | W | Concrete | Head gt | 9,375 | Manual | AG | 0.88 | 11.5 | 60 | AC |
| .. | .... | | 2 | 103,000 | Francis | 150 | 480–243 | 330 | AC | AC | Plate st | Head gt | 75,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | GE |
| | .... | 522,000 | 2 | 3,500 | Francis | 600 | ..... | 330 | JL | W | Cast st | Head gt | 2,500 | Auto or man. | AG | 0.80 | 2.4 | 60 | GE |
| 2 | 1947 | | 2 | 103,000 | Francis | 150 | 480–243 | 330 | AC | AC | Plate st | Head gt | 75,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | GE |
| 1 | 1948 | | 1 | 103,000 | Francis | 150 | 480–243 | 330 | AC | AC | Plate st | Head gt | 75,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | GE |
| .. | .... | 102,000 | 3 | 34,000 | Francis | 94.7 | 102–46 | 90 | MS | W | Concrete | Head gt | 25,000 | Auto or man. | AG | 1.00 | 13.8 | 60 | GE |
| .. | .... | 4,410 | 2 | 1,135 | Francis | ... | 35–30 | 34 | .... | .. | ..... | ..... | 1,000 | ..... | HS | .... | .... | .. | ..... |
| 1 | 1946 | | 1 | 2,140 | Francis | 240 | 35–30 | 34 | MS | W | Concrete | Head gt | 1,875 | Manual | AG | 0.80 | 2.4 | 60 | EM |
| | .... | 177,000 | 3 | 44,000 | Francis | 428 | 830 | 760 | PW | W | Cast st | Butterfly | 33,000 | Manual | AG | 0.80 | 11.0 | 50 or 60 | WE |
| 1 | 1948 | | 1 | 45,000 | Francis | 450 | 830 | 760 | PW | W | Cast st | Butterfly | 35,000 | Manual | AG | 0.80 | 12.5 | 60 | WE |
| .. | .... | 17,000 | 1 | 17,000 | Francis | 300 | 320 | 312 | AC | W | Plate st | Butterfly | 16,000 | Auto or man. | AG | 0.85 | 11.5 | 60 | AC |
| .. | .... | 112,500 | 3 | 37,500 | Impulse | 225 | 1268 | 1223 | PW | W | None | Butterfly | 33,000 | Auto or man. | HS | 0.90 | 13.8 | 60 | AC |
| .. | .... | 4,600 | 1 | 4,600 | Propeller | 240 | 51–48 | 45 | DEW | W | Concrete | Head gt | 4,000 | Automatic | AG | 0.85 | 6.9 | 60 | CWC |
| .. | .... | 1,450 | 1 | 1,450 | Francis | 900 | 266 | 261 | CAC | .. | ..... | ..... | ..... | ..... | HS | .... | .... | .. | ..... |
| .. | .... | ..... | 1 | 320 | Francis | 720 | ..... | ... | ..... | W | ..... | ..... | 312 | Automatic | HS | 0.80 | 2.3 | 60 | CWC |
| | .... | | 4 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 43,886 | ..... | BG | 0.85 | 13.2 | 25 | 3 CGE, 1 OC |
| .. | .... | | 4 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 46,625 | ..... | BG | 0.90 | 13.2 | 60 | CGE |
| .. | .... | | 2 | 8,000 | Francis | 180 | 83 | 80 | DEW | DEW | Concrete | Head gt | 7,200 | ..... | .. | 0.90 | 13.2 | 60 | CGE |
| 1 | 1939 | 758,000 | 1 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 46,625 | ..... | BG | 0.90 | 13.2 | 60 | CGE |
| 2 | 1940 | | 2 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 43,886 | ..... | BG | 0.85 | 13.2 | 25 | CGE |
| 2 | 1941 | | 2 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 46,625 | ..... | BG | 0.90 | 13.2 | 60 | CGE |
| 1 | 1947 | | 1 | 53,000 | Francis | 75 | 83 | 80 | DEW | DEW | Concrete | Head gt | 46,625 | ..... | BG | 0.90 | 13.2 | 60 | CGE |
| .. | .... | 195,000 | 3 | 65,000 | Francis | 120 | 150–130 | 145 | DEW | W | Plate st | Head gt | 62,500 | Auto or man. | AG | 0.80 | 13.8 | 60 | CGE |
| | | | 3 | 24,000 | Francis | 90 | 66 | 66 | DEW | W | Plate st | Head gt | 25,000 | Manual | AG | 0.85 | 6.6 | 60 | CGE |
| 1 | 1947 | 126,000 | 1 | 24,000 | Francis | 88 | 66 | 66 | DEW | W | Plate st | Head gt | 22,500 | Manual | AG | 0.90 | 6.6 | 25 | CGE |
| .. | .... | | 1 | 24,000 | Francis | 90 | 66 | 66 | DEW | W | Plate st | Head gt | 25,000 | Manual | AG | 0.85 | 6.6 | 60 | CGE |
| 1 | .... | ..... | 1 | 330 | Francis | 900 | 100 | 100 | ..... | W | Concrete | Head gt | 250 | Manual | HS | 0.80 | 2.4 | 60 | EEC |
| .. | .... | 6,000 | 1 | 6,000 | Francis | 200 | 75 | 75 | MSC | W | Plate st | Head gt | 5,000 | ..... | AG | 0.85 | 4.16 | 60 | CWC |
| .. | .... | ..... | 1 | ..... | ..... | 1,200 | ..... | ... | .... | .. | ..... | ..... | 219 | ..... | HS | 0.80 | 0.55 | 60 | CGE |
| | .... | 147,000 | 1 | 72,000 | Francis | 150 | 275–267 | 265 | CAC | W | Plate st | Head gt | 48,500 | Manual | AG | 0.85 | 13.2 | 25 | CGE |
| 1 | 1947 | | 1 | 75,000 | Francis | 166.7 | 275–267 | 265 | CAC | W | Plate st | Head gt | 64,000 | Manual | AG | 0.85 | 13.2 | 25 | CGE |
| .. | .... | 56,000 | 2 | 28,000 | Francis | 163.6 | 131–155 | 148 | CAC | W | Plate st | Head gt | 24,000 | Manual | AG | 0.85 | 13.2 | 60 | CGE |
| | | | 2 | 5,000 | Propeller | 180 | 44–26 | 36 | MSI | W | Concrete | Head gt | 4,500 | Manual | AG | 0.85 | 6.6 | 60 | OC |
| 1 | 1940 | 25,000 | 1 | 7,500 | Kaplan | 150 | 44–26 | 36 | MSI | W | Concrete | Head gt | 6,000 | Manual | AG | 0.90 | 6.6 | 60 | CWC |
| 1 | 1948 | | 1 | 7,500 | Kaplan | 150 | 44–26 | 36 | MSC | W | Concrete | Head gt | 6,000 | Manual | AG | 0.90 | 6.6 | 60 | CWC |
| .. | .... | 496,000 | 6 | 62,000 | Francis | 105.9 | 135–124 | 130 | DEW | W | Plate st | ..... | 50,000 | Manual | AG | 0.90 | 13.8 | .. | ..... |
| .. | .... | 55,000 | 2 | 27,500 | Francis | 257 | 300–275 | 300 | DEW | W | Plate st | Butterfly | 22,500 | Manual | AG | 0.90 | 13.8 | 60 | CWC |
| .. | .... | 3,440 | 1 | 1,130 | Francis | 514 | 62–56 | 58 | CBS | W | Plate st | Head gt | 1,000 | Manual | HS | 0.80 | 2.3 | 60 | CGE |
| | | | 1 | 250 | Francis | ... | 62–56 | 58 | CBS | W | Plate st | Head gt | 225 | Manual | HS | 0.80 | 2.3 | 60 | CGE |
| .. | .... | 2,400 | 1 | 1,200 | Francis | 360 | 51–44 | 44 | CBS | W | Plate st | Head gt | 1,000 | Automatic | HS | 0.80 | 6.9 | 60 | CGE |
| .. | .... | 10,000 | 1 | 10,000 | Francis | 144 | 64 | 64 | CAC | W | Concrete | Head gt | 7,500 | Manual | AG | 0.80 | 2.4 | 60 | CWC |
| | .... | | 2 | 12,000 | Propeller | 94.7 | 33–22 | 30 | DEW | W | Concrete | Head gt | 10,000 | Manual | AG | 1.00 | 6.6 | 60 | SGE |
| 1 | 1937 | | 1 | 12,000 | Propeller | 94.7 | 33–22 | 30 | DEW | W | Concrete | Head gt | 10,000 | Manual | AG | 1.00 | 6.6 | 60 | SGE |
| 1 | 1938 | 96,000 | 1 | 12,000 | Propeller | 94.7 | 33–22 | 30 | DEW | W | Concrete | Head gt | 10,000 | Manual | AG | 1.00 | 6.6 | 60 | SGE |
| 2 | 1946 | | 2 | 12,000 | Propeller | 94.7 | 33–22 | 30 | DEW | W | Concrete | Head gt | 10,000 | Manual | AG | 1.00 | 6.6 | 60 | CGE |
| 2 | 1947 | | 2 | 12,000 | Propeller | 94.7 | 33–22 | 30 | DEW | W | Concrete | Head gt | 10,000 | Manual | AG | 1.00 | 6.6 | 60 | CGE |
| | .... | | 3 | 19,000 | Propeller | 150 | 56 | 56 | DEW | W | Concrete | Head gt | 18,000 | Manual | AG | 0.90 | 6.6 | 60 | CGE |
| 1 | 1937 | 114,000 | 1 | 19,000 | Propeller | 150 | 56 | 56 | DEW | W | Concrete | Head gt | 18,000 | Manual | AG | 0.80 | 6.6 | 60 | CGE |
| 1 | 1939 | | 1 | 19,000 | Propeller | 150 | 56 | 56 | DEW | W | Concrete | Head gt | 18,000 | Manual | AG | 0.90 | 6.6 | 60 | CGE |
| 1 | 1948 | | 1 | 19,000 | Propeller | 150 | 56 | 56 | DEW | W | Concrete | Head gt | 18,000 | Manual | AG | 0.90 | 6.6 | 60 | CGE |
| .. | .... | 8,490 | 1 | 8,300 | Francis | 128.5 | 60–50 | 56 | MSC | W | Plate st | Head gt | 7,000 | Manual | AG | 1.00 | 6.9 | 60 | CGE |
| | | | 1 | 190 | Francis | 900 | 60–50 | 56 | MSC | W | ..... | ..... | 150 | Manual | HS | 0.80 | 0.55 | 60 | CGE |
| .. | .... | 13,500 | 1 | 13,500 | Francis | 225 | 151–126 | 135 | DEW | DEW | Plate st | Head gt | 11,250 | Automatic | AG | 0.85 | 13.2 | 60 | CWC |
| .. | .... | 620,000 | 1 | 62,500 | Impulse | 300 | ..... | 1,130 | PW & VEW | .. | ..... | ..... | 50,000 | ..... | AG | 0.90 | 13.8 | 60 | CWC |
| | .... | 48,000 | 1 | 24,000 | Francis | 333.3 | 425–300 | 375 | DEW | W | Plate st | Johnson | 18,000 | ..... | AG | 0.80 | 6.6 | 50 | CGE |
| 1 | 1947 | | 1 | 24,000 | Francis | 333.3 | 425–300 | 375 | DEW | W | Plate st | Johnson | 18,000 | ..... | AG | 0.80 | 6.6 | 50 | CGE |
| .. | .... | 150,000 | 2 | 28,000 | Francis | 327.3 | 480–394 | 390 | DEW | W | Plate st | Butterfly | 25,000 | Manual | AG | 0.80 | 13.8 | 60 | CWC |
| 5,000 acre-ft of storage in Campbell Lake to increase firm capacity of Campbell River plant. Provisions made for future power development at Ladore Falls storage dam | | | | | | | | | | | | | | | | | | | |
| .. | .... | 3,650 | 1 | 3,650 | Impulse | 514 | ..... | 920 | PW & VEW | W | ..... | ..... | 2,812 | Manual | AC | 0.80 | 4.16 | 60 | CWC |
| .. | ... | ..... | 1 | ..... | ..... | 900 | ..... | ... | ..... | .. | ..... | ..... | 125 | ..... | HS | 0.80 | 2.3 | 60 | EEC |

MSC —Morgan Smith, Canada, Ltd
MSI —S Morgan Smith-Inglis, Ltd
VEW—Vancouver Engineering Works, Ltd
EC —Elliott Co
EM —Electric Machinery Mfg Co

WE —Westinghouse Electric Corp
CGE —Canadian General Electric Co, Ltd
CWC —Canadian Westinghouse Co, Ltd
EEC —English Electric Co of Canada, Ltd
OC —Oerlikon, Canada, Ltd

*AG indicates that the thrust bearing is above generator; BG, thrust bearing is below the generator; HS, horizontal-shaft machine.

† Units installed in 1928, rated 35,000 hp, have been rebuilt for 44,000 hp.

kwhr, or about 1,000,000,000 more than in 1945. Power division, between steam and hydro generation and public utility and Government plants, remained about the same as in 1945, Fig. 2.

In Canada, as in the U. S., and for practically the same reasons, very little hydroelectric capacity (27,600 hp) went into service in 1946. Total installed capacity is now 10,275,000 hp. There are over 1,000,000 hp of new capacity however, either being installed or on order, of which about 250,000 hp will go into service this year. Among the outstanding plants under construction is Des Joachims of the Hydro Electric Power Commission of Ontario on the Ottawa River, designed for eight 62,000-hp units, six of which are on order. Shawinigan No. 3 plant. Shawinigan Water & Power Co will have three 65,000-hp units, all of which are on order. Work has been started on the Bridge River plant of the British Columbia Electric Co. This plant is designed for ten 62,000-hp units under a 1130-ft head, one of which is on order. The fourteenth 53,000-hp unit is being installed in the Beauharnois plant of Quebec Hydro-Electric Commission.

## HYDROELECTRIC PROJECTS CONSTRUCTED AND OPERATED BY GOVERNMENT AGENCIES

| Government Agency | Project | State | River | Ultimate Capacity, Hp | Initial Capacity, Hp | Installed Capacity, Hp | On Order, Hp |
|---|---|---|---|---|---|---|---|
| U. S. Bureau of Reclamation | Grand Coulee | Wash. | Columbia | 2,877,000 | 478,000 | 928,000 | 945,000 |
| U. S. Engineer Corps | Bonneville | Ore. & Wash. | Columbia | 729,000 | 137,000 | 729,000 | ..... |
| U. S. Bureau of Reclamation | Anderson Ranch | Idaho | Boise | 55,000 | 37,000 | ..... | 37,000 |
| | Minidoka | Idaho | Snake | 26,500 | 9,000 | 19,500 | ..... |
| | Shasta | Calif. | Sacramento | 522,000 | 419,000 | 419,000 | 103,000 |
| | Keswick | Calif. | Sacramento | 102,000 | 102,000 | ..... | 102,000 |
| Imperial Irrigation District | Drop No. 3 | Calif. | All Am Canal | 15,000 | 7,500 | 7,500 | ..... |
| | Drop No. 4 | Calif. | All Am Canal | 26,600 | 13,300 | 13,300 | ..... |
| U. S. Bureau of Reclamation | Parker Dam | Ariz. & Calif. | Colorado | 160,000 | 120,000 | 160,000 | ..... |
| | Davis Dam | Ariz. & Calif. | Colorado | 311,000 | 311,000 | ..... | 311,000 |
| | Boulder Dam | Ariz. & Nev. | Colorado | 1,835,000 | 522,000 | 1,435,000 | ..... |
| | Elephant Butte | N. M. | Rio Grande | 34,500 | 34,500 | 34,500 | ..... |
| | Green Mountain | Colo. | Blue | 30,000 | 30,000 | 30,000 | ..... |
| | Estes | Colo. | Big Thompson | 63,000 | 63,000 | ..... | 63,000 |
| | Mary's Lake | Colo. | Big Thompson | 11,300 | 11,300 | ..... | 11,300 |
| | Kortes | Wyo. | North Platte | 55,500 | 55,500 | ..... | 55,500 |
| | Shoshone | Wyo. | Shoshone | 20,000 | 20,000 | 20,000 | ..... |
| | Heart Mountain | Wyo. | Shoshone | 8,300 | 8,300 | ..... | 8,300 |
| | Boysen | Wyo. | Big Horn | 21,000 | 21,000 | ..... | ..... |
| | Seminoe | Wyo. | North Platte | 45,000 | 45,000 | 45,000 | ..... |
| U. S. Engineer Corps | Fort Peck | Mont. | Missouri | 150,000 | 70,000 | 70,000 | ..... |
| Platte Valley Pub Pr & Irr Dist | Sutherland | Neb. | North Platte | 35,000 | 35,000 | 35,000 | ..... |
| Loup River Public Power Dist | Monroe | Neb. | Loup | 9,600 | 9,600 | 9,600 | ..... |
| | Columbus | Neb. | Loup | 54,000 | 54,000 | 54,000 | ..... |
| Central Neb. Pub Pr & Irr Dist | Jeffery Canyon | Neb. | Platte | 26,000 | 26,000 | 26,000 | ..... |
| | Johnson No. 1 | Neb. | Platte | 26,000 | 26,000 | 26,000 | ..... |
| | Johnson No. 2 | Neb. | Platte | 50,000 | 25,000 | 25,000 | ..... |
| U. S. Engineer Corps | St. Mary's Falls | Mich. | St. Mary's | 23,925 | 23,925 | ..... | 23,925 |
| | Norfolk | Ark. | North Fork | 168,000 | 42,000 | 42,000 | 42,000 |
| Grand River Dam Authority | Narrows | Ark. | Little Missouri | 36,000 | 24,000 | ..... | ..... |
| U. S. Engineer Corps | Pensacola Dam | Okla. | Grand | 100,000 | 80,000 | 100,000 | ..... |
| | Fort Gibson | Okla. | Grand | 120,000 | 80,000 | ..... | 80,000 |
| Lower Colorado River Authority | Dennison Dam | Okla. & Texas | Red | 283,080 | 59,080 | 59,080 | 56,000 |
| | Buchanan Dam | Texas | Colorado | 51,900 | 34,600 | 34,600 | ..... |
| | Tom Miller | Texas | Colorado | 20,000 | 20,000 | 20,000 | ..... |
| | Inks Dam | Texas | Colorado | 16,000 | 16,000 | 16,000 | ..... |
| | Marshall Ford | Texas | Colorado | 90,000 | 90,000 | 90,000 | ..... |
| Brazos Riv Conser & Reclam Dist | Possum Kingdom | Texas | Brazos | 51,000 | 34,000 | 34,000 | ..... |
| U. S. Engineer Corps | Wolf Creek | Ky. | Cumberland | 414,000 | 207,000 | ..... | 207,000 |
| Tennessee Valley Authority | Kentucky | Ky. | Tennessee | 220,000 | 176,000 | 176,000 | 44,000 |
| | Pickwick | Tenn. | Tennessee | 288,000 | 96,000 | 192,000 | ..... |
| | Wilson | Ala. | Tennessee | 610,000 | 206,000 | 470,000 | ..... |
| | Wheeler | Ala. | Tennessee | 360,000 | 90,000 | 180,000 | 90,000 |
| | Guntersville | Ala. | Tennessee | 136,000 | 102,000 | 102,000 | ..... |
| | Hales Bar | Tenn. | Tennessee | 44,000 | 44,000 | 44,000 | ..... |
| | Chickamauga | Tenn. | Tennessee | 144,000 | 108,000 | 108,000 | ..... |
| | Watts Bar | Tenn. | Tennessee | 210,000 | 126,000 | 210,000 | ..... |
| | Norris | Tenn. | Clinch | 132,000 | 132,000 | 132,000 | ..... |
| | Fort Loudoun | Tenn. | Tennessee | 176,000 | 88,000 | 88,000 | 88,000 |
| | Cherokee | Tenn. | Holston | 166,000 | 83,000 | 83,000 | ..... |
| | Douglas | Tenn. | French Broad | 166,000 | 83,000 | 83,000 | 41,500 |
| | South Holston | Tenn. | South Holston | 41,500 | 41,500 | ..... | ..... |
| | Watauga | Tenn. | Watauga | 69,000 | 69,000 | ..... | 69,000 |
| | Fontana | N. C. | Little Tennessee | 274,000 | 183,000 | 183,000 | ..... |
| | Apalachia | Tenn. | Hiwassee | 106,000 | 106,000 | 106,000 | ..... |
| | Hiwassee | N. C. | Hiwassee | 160,000 | 80,000 | 80,000 | ..... |
| | Chatuge | N. C. | Hiwassee | 10,700 | 10,700 | ..... | ..... |
| | Nottely | Ga. | Nottely | 13,400 | 13,400 | ..... | ..... |
| | Ocoee No. 3 | Tenn. | Ocoee No. 3 | 33,500 | 33,500 | 33,500 | ..... |
| U. S. Engineer Corps | Central Hill | Tenn. | Carney Fork | 207,000 | 138,000 | ..... | 138,000 |
| | Dale Hollow | Tenn. | Obey | 75,000 | 50,000 | ..... | 50,000 |
| | Allatoona | Ga. | Etowah | 152,900 | 102,900 | ..... | 102,900 |
| S. Carolina Public Service Auth | Santee-Cooper | S. C. | Santee | 213,000 | 173,000 | 173,000 | ..... |
| Greenwood County Board of Comm | Buzzards | S. C. | Saluda | 30,000 | 22,200 | 22,200 | ..... |
| Total Capacity | | | | 12,706,225 | | 6,947,780 | 2,698,425 |

# Save Hours of Calculation By Using Energy-Load and Load Duration Curves

**If plant loads and operating costs have to be estimated over a period of one to several years, both management and operators can save much time by using these curves. While they may not be entirely accurate at times, they provide a quick check**

By GLENN C BOYER
*Associate Professor of Mechanical Engineering, Missouri School of Mines and Metallurgy*

► EVERYONE buying or generating electrical energy for industrial and utility service has had to deal with problems of *base-load* and *peak-load* requirements. Industrial plant management buying part of its electricity and generating the remainder wants to know the proper balance between the two to reduce power cost to a minimum. Likewise, a plant operator wants to know how to supply the station peak load for least cost. Too often those responsible for such studies make many involved calculations to arrive at an answer although *energy-load* and *load duration* curves would save time and paper.

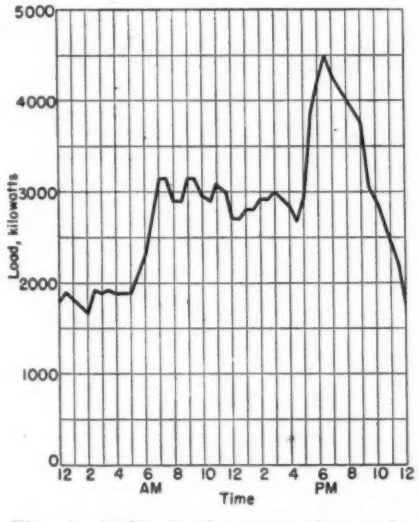



Fig. 1—Daily load curve shows demand on plant at any time of the day

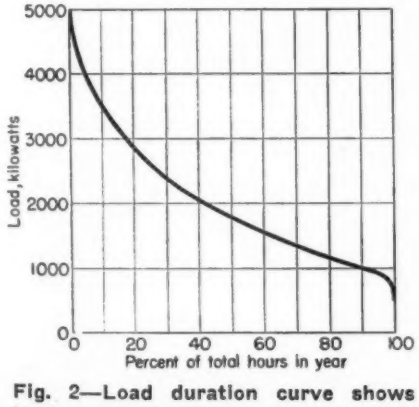



Fig. 2—Load duration curve shows load variation over any period desired —day, week, month, year or more

**Daily Load Curve.** A practically universal means for plotting load changes is the daily load curve, in which time is the horizontal axis and load the vertical axis, showing the variation in load over a 24-hr period. While such a curve, Fig. 1, shows the instantaneous load and aids the plant operator in scheduling units for operation, it has little value for the type of study considered here. Only a means for showing load variation during a yearly period will fill the need.

**Load Duration Curve.** The load duration curve, Fig. 2, shows the load variation for any period of time desired in a way that lends itself readily to interpretation. Any point on the curve shows the percentage of total period hours when the load exceeded a given value. In Fig. 2, while the peak load equals 5000 kw, the load exceeded 3575 kw for 10% of the time, and 2075 kw for 40% of the time.

Load duration curves are produced by grouping all the hours during a year when a particular load happened, and then summing up the total hours during which greater loads occurred.* It is the usual practice to start with the largest load. For each load plotted on the curve, the time corresponding to that load is the summation of all the hours at which this load as well as greater loads occurred. Much time is saved if load values are collected in groups, each group covering a small portion of the load range. Generally 20 load groups are enough. For example, where the maximum load is 5000 kw and the minimum 500 kw, load groups ranging over 250 kw provide sufficient accuracy. The divisions would run 500 to 749 kw inclusive, 750 to 999 kw inclusive, 1000 to 1249 kw and so on.

In plotting the curve single points are used; these are the minimum kw value in the groups. Thus, all the loads between 1000 and 1249 kw would be grouped together and plotted on the duration curve as 1000 kw, the minimum value in the group. Highest and lowest loads are the only ones plotted at their actual values. Data for Fig. 2 are shown in Table I, p 80.

Area under the load duration curve measures the total energy output, since the horizontal axis represents time, and the vertical axis the rate of energy production, or load. For example, if one inch horizontally represents 20% of the total annual hours, or 1752 hr, and one inch vertically represents 500 kw, then one sq in. area under the curve = $1752 \times 500 = 876{,}000$ kwhr.

While the load duration curve shows the load variation for any period desired, it does not give readily the relationship between load and the total energy produced. Inspecting the load

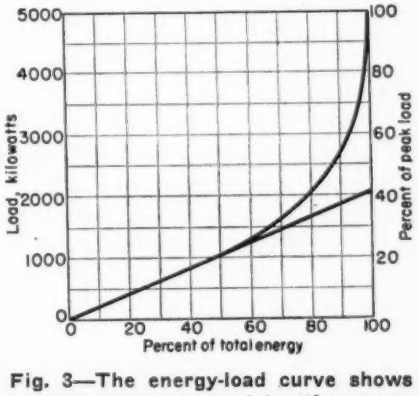



Fig. 3—The energy-load curve shows energy amount in load-duration curve area under any horizontal load line

*See "The Load Duration Curve," by A G Christie, POWER, Feb. 16, 1932, pp 243-5.

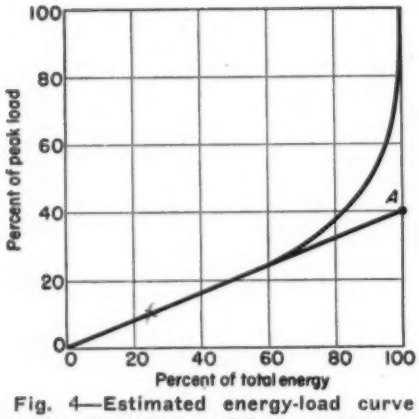



Fig. 4—Estimated energy-load curve with a load factor of forty percent as shown by the straight-line projection

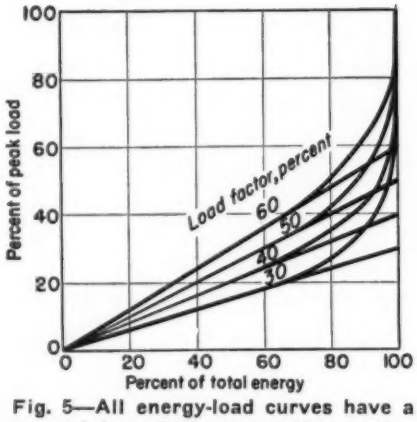



Fig. 5—All energy-load curves have a general hyperbolic shape that makes a close estimate of conditions easy

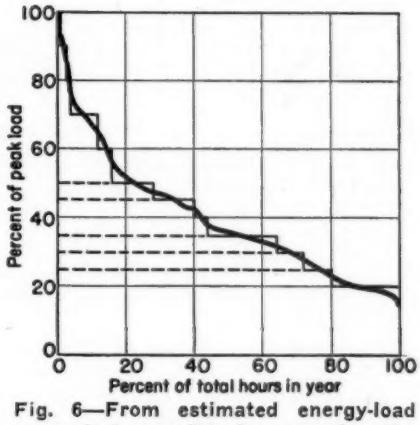



Fig. 6—From estimated energy-load curve it is possible by reversing the usual procedure to plot load duration

duration curve, Fig. 2, shows that most of the area under the curve lies below a value of 2000 kw. Since the area under the curve is proportional to the total energy and since most of the area lies under load values of 2000 kw and less, it is evident that the bulk of the energy is required at loads ranging from 500 to 2000 kw.

**Energy-Load Curve.** If areas under the load duration curve for each 500 kw are determined and such areas expressed as a percentage of the total area under the load-duration curve, Table II, a relationship between load and percent total energy generation can be determined and the energy-load curve plotted, Fig. 3. Such a curve aids studies of power economics. In this example, 80% of the energy is needed by loads ranging from 500 to 2000 kw, or from 10 to 40% of the peak load. Furthermore, 50% of the peak load supplies 88% of all energy in the curve.

A straight line connecting the origin of the curve and the percentage of energy supplied by the minimum load, when extended to the right-hand side, intersects the vertical ordinate at a value equaling the average load (left-hand scale) or the yearly load factor (right-hand) scale. Thus, in Fig. 3 average load equals 2050 kw, and the annual load factor is 41%.

**Estimating Energy-Load Curves.** Occasionally an energy-load curve is wanted when the total electrical energy, purchased or generated for a year, and the peak load are the only data known. It is possible to approximate an energy-load curve from these data as demonstrated in the following example.

In a particular installation 2,628,000 kwhr are needed annually and the peak load is 750 kw. Annual load factor then equals 2,628,000/(750×8760) or 40%. A curve is then plotted in Fig. 4 as follows:

1. Lay out a scale of percent of total energy on the horizontal axis.
2. Lay out a scale of percent of peak load on the vertical axis up to 100%.
3. At 100% energy, plot 40% load factor as at point *A*.
4. Connect point *A* with the origin by a straight line.
5. Draw a smooth curve tangent to this straight line terminating at the upper right corner, 100% energy and 100% load. This curve should be hyperbolic in shape, the characteristic form for energy-load curves.

It can be rightfully argued that the empirical curve in Fig. 4 has no basis in fact and may vary considerably from actual load conditions. Analysis of many such curves shows that, irrespective of load factor, peak load or total energy, they all tend to have the same general shape. Some typical curves for 30, 40, 50 and 60% load factors developed from actual plant data are shown in Fig. 5.

In many analyses a load duration

**TABLE I—DATA FOR LOAD DURATION CURVE**

| Load, kw | Period hours | Cumulative hours | % of total hours |
|---|---|---|---|
| 5000 | 1 | 1 | 0.0 |
| 4750–4999 | 87 | 88 | 1.0 |
| 4500–4749 | 86 | 174 | 2.0 |
| 4250–4449 | 89 | 263 | 3.0 |
| 4000–4249 | 175 | 438 | 5.0 |
| 3750–3999 | 220 | 658 | 7.5 |
| 3500–3749 | 302 | 960 | 11.0 |
| 3250–3499 | 261 | 1221 | 14.0 |
| 3000–3249 | 357 | 1578 | 18.0 |
| 2750–2999 | 347 | 1925 | 22.0 |
| 2500–2749 | 435 | 2360 | 27.0 |
| 2250–2499 | 610 | 2970 | 33.9 |
| 2000–2249 | 760 | 3730 | 42.6 |
| 1750–1999 | 770 | 4500 | 51.4 |
| 1500–1749 | 1050 | 5550 | 63.4 |
| 1250–1499 | 1100 | 6650 | 75.9 |
| 1000–1249 | 1240 | 7890 | 90.1 |
| 750– 999 | 780 | 8670 | 99.0 |
| 500– 749 | 90 | 8760 | 100.0 |

**TABLE II—CALCULATION OF LOAD-ENERGY CURVE**

| Load, kw | % of peak load | Increment area under load duration curve | Cumulative increment areas | % of total area |
|---|---|---|---|---|
| 500 | 10 | 5.0 | 5.00 | 24.4 |
| 1000 | 20 | 4.87 | 9.87 | 48.1 |
| 1500 | 30 | 3.86 | 13.73 | 66.9 |
| 2000 | 40 | 2.65 | 16.38 | 79.8 |
| 2500 | 50 | 1.70 | 18.08 | 88.1 |
| 3000 | 60 | 1.12 | 19.20 | 93.6 |
| 3500 | 70 | 0.70 | 19.90 | 97.0 |
| 4000 | 80 | 0.40 | 20.30 | 98.9 |
| 4500 | 90 | 0.17 | 20.47 | 99.8 |
| 5000 | 100 | 0.05 | 20.52 | 100.0 |

**TABLE III—CALCULATION OF LOAD DURATION CURVE**

| From curve: % of peak load | From curve: % of total energy | % energy differentials | Increment areas under load duration curve |
|---|---|---|---|
| 15 | 37.0 | 37.0 | 14.8 |
| 20 | 50.0 | 13.0 | 5.2 |
| 25 | 60.0 | 10.0 | 4.0 |
| 30 | 69.0 | 9.0 | 3.6 |
| 35 | 77.0 | 8.0 | 3.2 |
| 40 | 82.5 | 5.5 | 2.2 |
| 45 | 87.5 | 5.0 | 2.0 |
| 50 | 91.0 | 3.5 | 1.4 |
| 55 | 93.0 | 2.0 | 0.8 |
| 60 | 95.0 | 2.0 | 0.8 |
| 65 | 96.5 | 1.5 | 0.6 |
| 70 | 98.0 | 1.5 | 0.6 |
| 80 | 99.0 | 1.0 | 0.4 |
| 90 | 99.8 | 0.8 | 0.32 |
| 100 | 100.0 | 0.2 | 0.08 |
| | | 100.0 | 40.00* |

Since load factor is 40% there are 40 units of area in load duration curve.

curve in addition to the energy-load curve is needed. In such a situation the energy-load curve is first estimated as described and with this as a basis the load duration curve can be computed. Table III shows the necessary calculations for such a curve, derived from the energy-load curve of Fig. 4.

When a load duration curve is plotted in terms of percentages for both load and time, the area under the curve numerically equals the percentage value of the load factor. For example, if the entire area of the coordinates for 100% peak load and 100% time is 100 units, then for a 40% load factor the area under the curve is 40 units. Then the sum of the increment areas in Table III equals 40 units. Individual increment areas are obtained by multiplying 40 by the values for differential energy percentages.

Plotting the load duration curve, Fig. 6, from Table III involves several steps. This method gives a block form first, from which the smoothed curve can be drawn.

1. Minimum load has 100% hours' duration, which locates this point at 15% load.

2. Add together first two increment areas 14.8 + 5.2 = 20 units. This block should have 100% time duration. Block load = (area units)100/(% time) = 20 × 100/100 = 20%.

3. Percent time for increment area between 20 and 25% load is then 4.0× 100/(25−20) = 80%.

4. Percent time for increment area between 30 and 25% load is then 3.6× 100/(30−25) = 72%.

5. Each block is so computed up to 100% load and plotted.

6. To obtain a smooth curve connect maximum load point to midpoint on step, continuing through these step midpoints to end at minimum load point. When the approximately triangular areas between the smooth curve and stepped curve are equal, the total areas under each curve are equal.

## USING ESTIMATED CURVES

Now let's see how these estimated energy-load and load duration curves can be applied. An industrial plant has been producing all its power with a condensing-steam-turbine generating unit of 1000-kw capacity. Steam is not needed for heating purposes. Additional manufacturing facilities are being installed and the demand for power is expected to be 1400 kw under the expanded program. The other data are:

| | |
|---|---|
| Peak load | 1400 kw |
| Total yearly energy | 5,500,000 kwhr |
| Annual load factor | 45% |
| Steam conditions | 400 psig, 700 F |
| Turbine vacuum at exhaust | 28 in. Hg |

Sufficient boiler capacity is available to operate two 1000-kw turbines.

The alternatives that can be followed are: (1) Plant capacity can be increased by adding another turbine unit. (2) Part of the energy can be purchased. When energy is bought, the turbine can be base loaded with purchased energy supplying the peak. Or the purchased energy can supply the base load and the turbine be used for peak-load service. In either event, we must know the division in energy and demand between purchased and generated sources.

First the estimated energy-load curve and its related load duration curve are developed, Fig. 9. Then for a 1400-kw peak demand the probable divisions between purchased and generated energy can be quickly estimated. Base loading the turbine at 1000 kw, 71.5% of peak load, will produce 98.5% of the energy needed with the turbine operating continuously. On the other hand, buying 400 kw of base-load power, 28.5% of peak load, while generating the remaining 1000 kw, will require purchasing 62% of the needed energy, the remaining 38% being generated. Complete calculations for both conditions are given in Table IV, p 82.

With this information, Table IV, and the turbine steam rates, Fig. 8, the average annual steam rate per kwhr generated can be calculated, Table V. With the turbine base loaded, the average load carried equals 5,417,500/8760 = 620 kw. With the turbine carrying peak load only, its average load equals

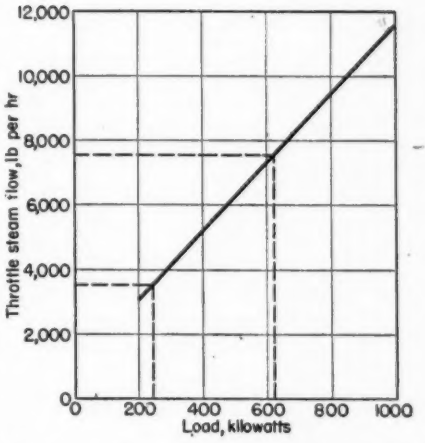



Fig. 8—Willians line for 1000-kw turbine in Tables 4 and 5 calculation

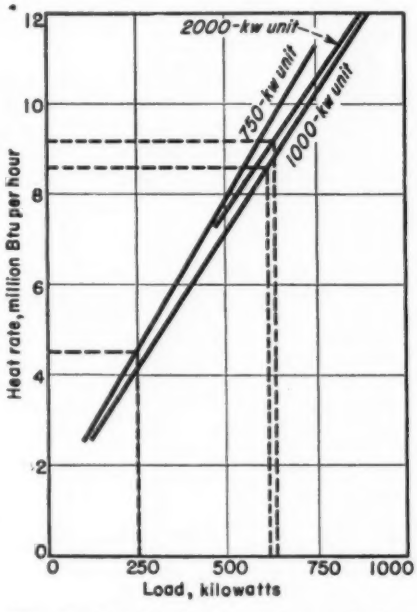



Fig. 7—Input-output curves of two turbines used in calculation, Table 6

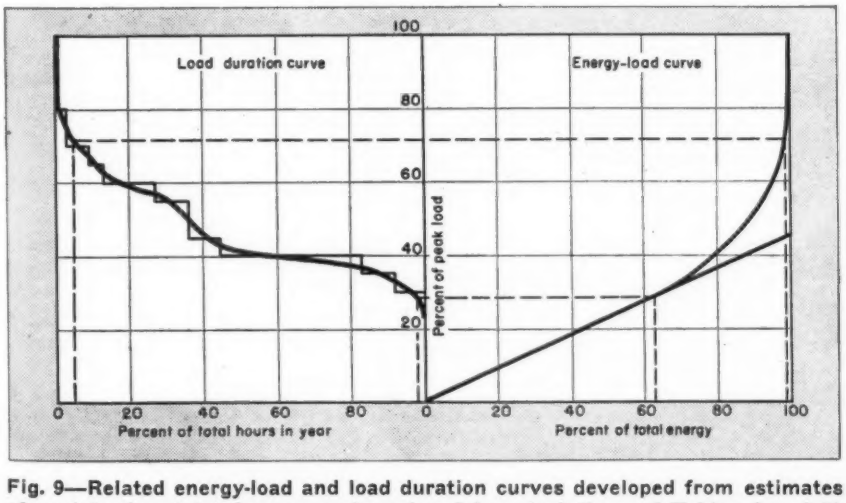



Fig. 9—Related energy-load and load duration curves developed from estimates of peak-load and total-energy values (used in calculations of Tables 4 and 5)

$2,090,000/8760 \times 0.98 = 245$ kw. With an average load of 620 kw, steam rate is 7500 lb per hr, or 12.1 per kwhr generated. For an average load of 245 kw the steam rate is 3500 lb per hr, or 14.25 lb per kwhr; probably this steam rate will be nearer 15 lb per kwhr because Willans lines are actually not straight at low loads.**

With the information developed as outlined, and knowing the purchased power costs and operating expenses for the two plans of operation, the comparative costs can be calculated.

**Load Division.** Let's look at another problem where we need these curves. A power-plant operator wants to know how to get the best economy from an installation of three turbines having capacities of 750, 1000 and 2000 kw. The smallest unit operates at 250 psi and 500 F through a reducing valve and desuperheater while the two larger machines operate at 400 psi and 700 F. Heat rates for all three machines are given in Fig. 7 and the plant energy-load and load duration curves in Fig. 10.

Plant peak load is 1600 kw, and the total generation is 5,500,000 kwhr annually for a load factor of 39.2%. The units must be operated in such a manner as to get the lowest station heat rate. Since the 2000-kw unit can carry the maximum load alone, find what the heat rate will be for this machine operating continuously. Then average load = 5,500,000/8760 = 628 kw. From Fig. 7 average heat input is 9,200,000 Btu per hr, or 14,650 Btu per kwhr.

Now consider the 750- and 1000-kw units supplying the total load. The operator can base load the 1000-kw unit using the 750-kw machine to carry the peaks, or vice versa. All data and calculations are summarized in Table VI. These show that the least heat will be used with the 1000-kw unit base loaded. Note from the previous calculation that the 2000-kw unit operating alone requires more heat, 14,650 Btu per kwhr, than the combination of the two smaller units.

Remember that the analysis in Table VI makes no allowances for warm-up losses in the small units. Even accounting for them, it is likely that the heat required for the operation of the two smaller machines, with the 1000-kw unit base loaded, will be no greater than that necessary for the 2000-kw unit operating continuously during the year.

**See "Short Cut to Steam Rate," by G C Boyer, POWER, Sept. 1938, p 56.

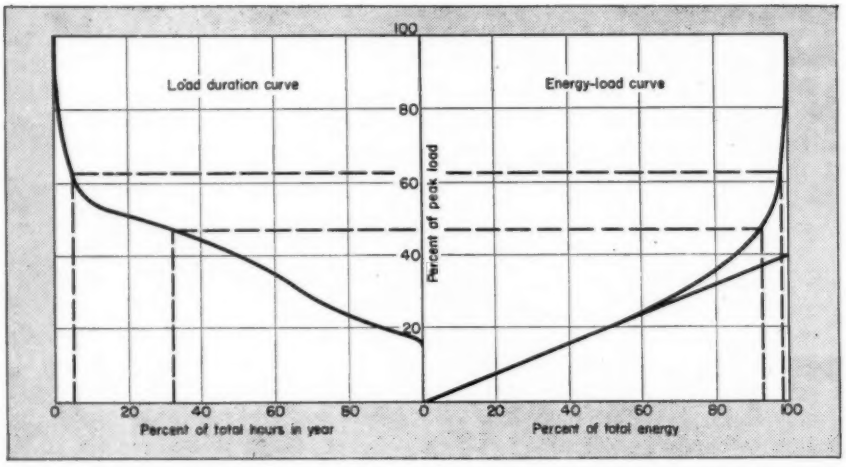



Fig. 10—Energy-load and load duration curves used in load division, Table 6

## TABLE IV—DIVISION OF PEAK LOAD AND ENERGY BETWEEN TURBINE AND PURCHASED POWER

Peak load = 1,400 kw  Energy = 5,500,000 kwhr

| Requirements supplied by: | Turbine | Purchased power |
|---|---|---|
| *Steam turbine carrying base load* | | |
| 1. Load carried during peak, kw | 1,000 | 400 |
| 2. Percent of peak load | 71.5 | 28.5 |
| 3. Percent of energy supplied* | 98.5 | 1.5 |
| 4. Kwhr supplied | 5,417,500 | 82,500 |
| 5. Percent of time used | 100 | 5 |
| *Purchased power carrying base load* | | |
| 1. Load carried during peak, kw | 1,000 | 400 |
| 2. Percent of peak load | 71.5 | 28.5 |
| 3. Percent of energy supplied* | 38.0 | 62.0 |
| 4. Kwhr supplied | 2,090,000 | 3,410,000 |
| 5. Percent of time used | 98 | 100 |

* Values taken from Fig. 7

## TABLE V—TURBINE STEAM-CONSUMPTION CALCULATIONS

### For Two Methods of Operation

| Operating condition | Base load | Peak load |
|---|---|---|
| 1. Kwhr generated | 5,417,500 | 2,090,000 |
| 2. Hours operated | 8,760 | 8,600 |
| 3. Average load, kw | 620 | 245 |
| 4. Average steam rate, lb per hr* | 7,500 | 3,500 |
| 5. Average unit steam rate, lb per kwhr | 12.1 | 14.25** |

* From Fig. 8.  ** Probably closer to 15 lb per kwhr because of relatively light turbine loading.

## TABLE VI—STUDY OF LOAD DIVISION BETWEEN 750- AND 1000-KW UNITS

Base load on 1000-kw unit:

| | | |
|---|---|---|
| 1. Turbine capacity, kw | 750 | 1,000 |
| 2. Load carried during peak, kw | 600 | 1,000 |
| 3. Percent of peak load | 37.5 | 62.5 |
| 4. Percent generation from Fig. 10 | 2 | 98 |
| 5. Kwhr generated = 5,500,000 × item 4 | 110,000 | 5,390,000 |
| 6. Percent of hours operated, from Fig. 10 | 5 | 100 |
| 7. Hours operated = 3760 × item 6 | 438 | 8,760 |
| 8. Average load, kw = item 5/item 7 | 251 | 615 |
| 9. Heat rate, $10^3$ Btu per hr, from Fig. 7 | 4.5 | 8.6 |
| 10. Annual input, $10^6$ Btu = item 7 × item 9 | 1,970 | 75,400 |

11. Total input to plant = 1,970 + 75,400 = 77,370 million Btu
12. Average plant heat rate = 77,370 × $10^3$/5,500,000 = 14,070 Btu per kwhr

Base load on 750-kw unit:

| | | |
|---|---|---|
| 1. Turbine capacity, kw | 750 | 1,000 |
| 2. Load carried during peak, kw | 750 | 850 |
| 3. Percent of peak load | 47 | 53 |
| 4. Percent generation, from Fig. 10 | 92.5 | 7.5 |
| 5. Kwhr generated | 5,087,000 | 413,000 |
| 6. Percent of hours operated, from Fig. 10 | 100 | 32 |
| 7. Hours operated | 8,760 | 2,800 |
| 8. Average load, kw | 581 | 148 |
| 9. Heat rate, $10^3$ Btu per hr, from Fig. 7 | 9.0 | 2.9* |
| 10. Annual input, $10^6$ Btu | 78,800 | 8,100 |

11. Total input to plant = 78,800 + 8,100 = 86,900 million Btu
12. Average plant heat rate = 86,900 × $10^3$/5,500,000 = 15,800 Btu per kwhr

* Actual heat rate will be higher because of extremely light load.

# Pioneer in The Use of Triethylene Glycol for Air Sterilization

**Adopting this form of glycol instead of refrigeration as a dehumidifying agent for air conditioning laid the foundation for some studies of its germicidal characteristics**

By THOMAS BARRETT
*Engineering Department*
*Seamen's Bank for Savings*

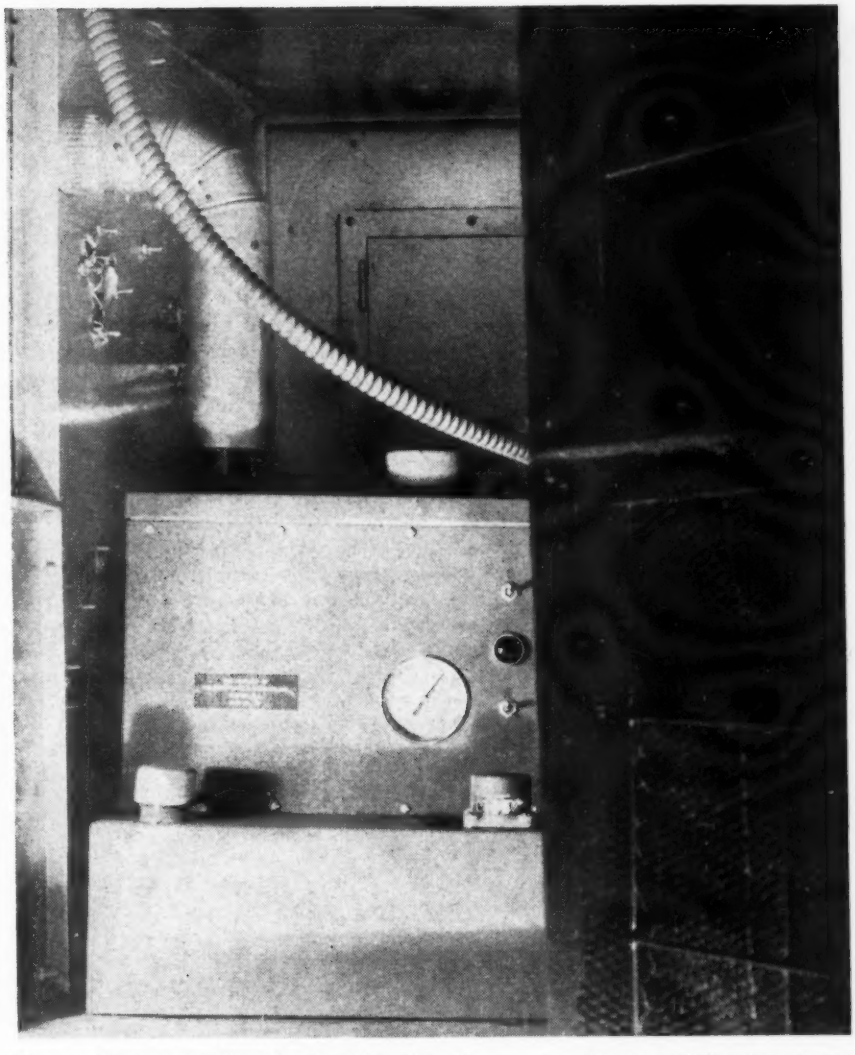


**Fig. 1—Glycol vaporizer installed in the plenum chamber containing the steam coils and filters. Self-contained heater maintains correct vaporizing rate**

▶ In 1939, Seamen's Bank for Savings, New York, N. Y. installed air-conditioning equipment to take care of banking and office spaces. To eliminate using refrigeration for humidity correction the engineers selected triethylene glycol as the dehumidifying agent: a hygroscopic liquid that removes water vapor by absorbing it without adding sensible heat to the air. Thus, only a small amount of refrigeration is needed to bring the air's temperature within comfort range. Original installation did not contemplate any germicidal effect.

**Early Investigations.** Almost simultaneously a group of London scientists were experimenting with hexylresorcinol and glycol mixtures, as germicides to prevent epidemic concentrations of bacteria in air-raid shelters. About this time, the Surgeon General of the U. S. Army, authorized to form a Commission on control of epidemics from airborne bacteria, appointed Dr O H Robertson, of the school of Medicine of Chicago University, as chairman. Getting to work, the Commission obtained assistance from the Research Corp, whose engineers were experienced in the use of glycol as a dehumidifying agent. Seamen's Bank gave permission to conduct investigations on the bank premises.

Doctors M Hamburger Jr and T T Puck, together with Army and Navy technicians and R E Waterman, S C Coey, J W Spiselman, F R Weaver and F W Schmitz of Research Corp, made up the investigating group. The four latter engineers recently organized Air Purification Service, Inc.

Tests were first made to determine whether sufficient glycol vapors were carried off in the air stream from the air-conditioning system to create concentrations having germicidal effect. A zero bacteria count was secured from duct air, but in the large banking space the count was only slightly reduced. A crude but effective device was then constructed to vaporize the glycol and feed it into the air stream. The higher concentration, although not noticeable to persons in the area, lowered the banking-room bacteria count from 200 to 16. Some tests showed a count of only one.

After obtaining these results, test setups were made to simulate conditions existing in every quarter of the globe where U. S troops were or might be stationed. Tropical and arctic conditions were obtained by feeding steam and low-temperature air respectively into the system. Encouraging results led to the manufacture of several hundred vaporizers for the Commission.

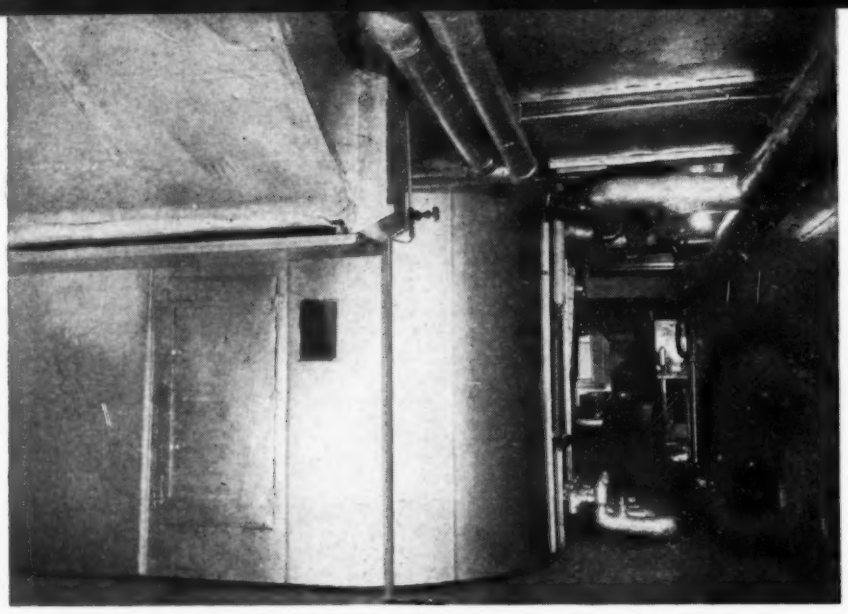


Fig. 2—Plenum chamber contains air filters, steam coils and vaporizer for two building zones. Chilled-water coils in ducts do a cooling job in summer

For instance it was easily possible to reduce bacteria count by 90%; reduction depending on the concentration maintained.

Subsequently the Commission authorized the installation of an improved vaporizer in the banking floor air-conditioning system. Chemists from the Research Corp maintained a 60 to 70% relative saturation because it reduced the bacteria count satisfactorily without showing any sign of glycol vapor or condensation.

**Related Tests.** Together with tests made at the Seamen's Bank, Dr Robertson and associates have conducted both laboratory and hospital-ward tests to gain further knowledge of triethylene glycol's germicidal value. Studies indicate that maximum efficiency is obtained with air at relative humidities between 30 and 70%. Equally effective killing can be achieved at lower humidities only if higher glycol relative saturation values are maintained.

Since 1943 many papers have been published in the *Journal of Infectious Diseases* as the result of tests made in hospitals and army camps demonstrating the ability of glycol to prevent cross infection from airborne bacteria. Although they make no commitments one way or another, committees of the National Institute of Health, U. S. Public Health Service are studying and reviewing the promising results obtained with glycol as a germicidal agent. Installations in Johns Hopkins Hospital, Baltimore, and Bellevue Hospital, New York, are now being tested.

The Seamen's Bank installation has been examined by hundreds of individuals representing health groups, drug manufacturers, insurance groups, health commissions, tobacco manufacturers and epidemic-control groups from South America.

**Bank Equipment.** Permanent triethylene glycol vaporizers have been installed throughout the air-conditioning system, in addition to its use as a dehumidifying agent. Central conditioning system consists of a double bank of air filters, dehumidifier, concentrator that restores glycol to full strength, refrigerating compressors that remove the air's sensible heat, blowers, necessary control elements and glycol vaporizers. Supplying 300,000 cu ft of space the system furnishes six complete air changes per hour at relative humidities of 48 to 52% and glycol relative saturation of 60 to 70%. Temperature difference is 12 to 15 F on maximum days and 5 to 10 F when outside dry-bulb temperature is 85 F, or less.

During winter months 100% fresh air is filtered, humidified with steam, heated and sterilized before delivery to each of four separate zones. In summer, 65% recirculated and 35% fresh air is de-

## PROPERTIES OF TRIETHYLENE GLYCOL

1 Moisture vapor pressure of a 95% solution at 90 F is 4 mm of mercury at 75 F, 2.2 mm and at 70 F, 1.8 mm.

2 Nonelectrolytic: Dissimilar metals in junction may be used without ill effects. Does not go over on the acid side after prolonged contact with city air. Requires no inhibitor or pH control, remains close to neutral.

3 Odorless: Destroys spores and molds responsible for musty odors in air-conditioning equipment.

4 Flashpoint 330 F. In air conditioning the glycol always contains some water and therefore should not flash at all.

5 A 92% solution has a vapor pressure of 120 mm at 200 F and can be economically concentrated at that temperature.

6 Glycol can be readily pumped.

7 A 95% solution has an initial crystallizing temperature of —16.8 F; 90% solution freezes at — 52. F.

8 Nontoxic at the relative saturation used. By volume glycol concentration is about 0.00007%, which compares to that of krypton in the atmosphere.

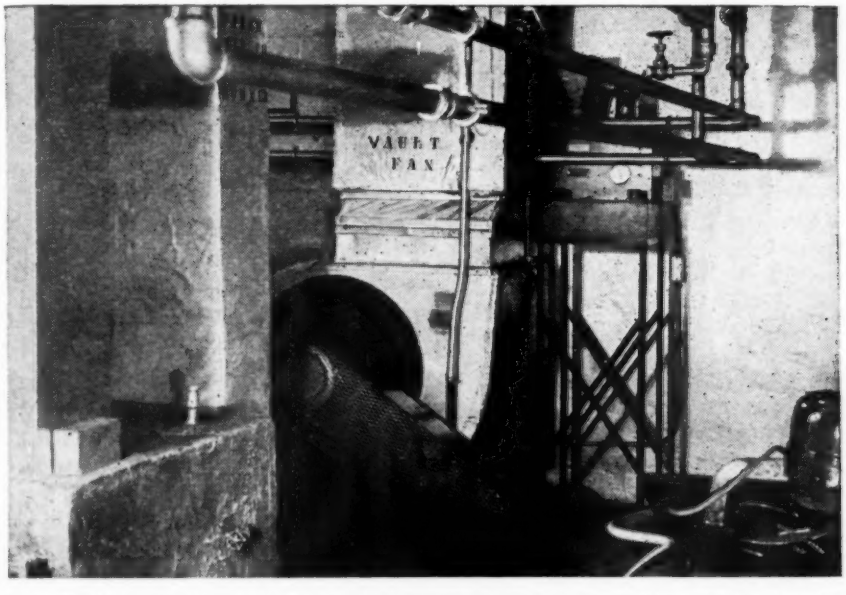



Fig. 3—A separate system, consisting of dehumidifier, inside cooling tower, necessary fans, concentrator and vaporizer, takes care of safety deposit vault

humidified, sterilized and cooled. Two Freon-12 condensing units (15 and 25 ton) take care of a chilled-water system that cools the air.

Twelfth floor offices are divided into two sections: one supplied by two 3½-ton unit conditioners and vaporizers and the other by a central condensing unit supplying Freon-12 to window units in each of twelve offices. A fourth unit conditioner and vaporizer in the basement serves the safety deposit vault.

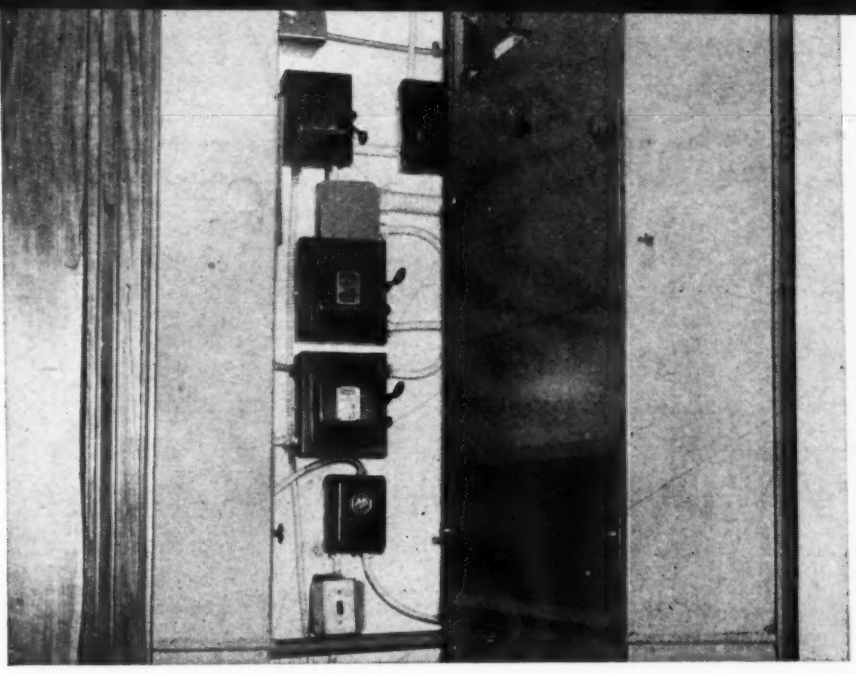


**Fig. 4—Two 3½-ton unit conditioners with glycol vaporizer (upper right) serve twelfth-floor offices with conditioned and sterilized outside air**

# Britain Adds 2,321,000 Kw to Grid System

LONDON: During 1946, the Central Electricity Board made arrangements with authorized undertakers for 2,321,000 kw of additions, to be made to the generating capacity of selected stations associated with the grid system. Expenditures involved total approximately $500,000,000.

The program includes provision for the first sections of seven new generating stations. As shown in the tabulation at the right, the authorized additions (1) complete provision for new plant, begun under earlier programs and planned for initial operation in the winters of 1948 and 1949, and (2) cover the greater part of the plant projected for installation under the program of extensions for 1950.

The tabulation shows the planned capacity additions by stations and by grid areas. Listed for each project are the name of the owner, the number and capacity of turbine-generators, and the number and capacity of boilers.

## ADDITIONS TO BRITISH GRID AUTHORIZED IN 1946

| *Scheme area* | *Name of station* | *Owners* | *Turbines, number and capacity, kw* | *Boilers, number and cap, lb/hr* |
|---|---|---|---|---|
| Scotland | Clyde's Mill | Clyde Valley E P Co | 2 x 30,000 | 4 x 180,000 |
| | Portobello | Edinburgh Corp | 1 x 60,000 | 1 x 540,000 |
| | Braehead | Glasgow Corp | 1 x 50,000 | 2 x 300,000 |
| North West England & North Wales | Bromborough | Birkenhead Corp | 2 x 50,000 | 4 x 300,000 |
| | Whitebirk | Blackburn Corp | 1 x 40,000 | 3 x 150,000 |
| | Carrington | Manchester Corp | 2 x 57,000<br>2 x 3,000* | 4 x 360,000 |
| | Agecroft | Salford Corp | (a)2 x 50,000<br>2 x 2,500* | 4 x 315,000 |
| | Hartshead | Staleybridge, Hyde, Mossley & Dukinfield T & E Board | 1 x 30,000<br>1 x 1,500* | 1 x 150,000 |
| | Westwood | Wigan Corp | 3 x 30,000 | 4 x 300,000 |
| Mid-East England | Grimsby | Grimsby Corp | ..... | 2 x 80,000 |
| | Skelton Grange | Leeds Corp | 3 x 60,000 | 6 x 360,000 |
| | Prince of Wales | Rotherham Corp | (b)1 x 50,000 | 2 x 200,000 |
| | | | 1 x 30,000 | 2 x 200,000 |
| | Thornhill | Yorkshire E P Co | 1 x 45,000 | 2 x 180,000 |
| Central England | Staythorpe | Derbyshire & Nottinghamshire E P Co | 3 x 60,000 | 9 x 240,000 |
| | Walsall | West Midlands Joint Electricity Authority | 2 x 30,000 | 4 x 150,000 |
| South East & East England | Brighton | Brighton Corp | 3 x 52,500 | 6 x 320,000 |
| | Bankside | City of London E L Co | 2 x 50,000 | 4 x 300,000 |
| | Barking | County of London E S Co | 3 x 75,000 | 6 x 405,000 |
| | Beddington | Croydon Corp | 1 x 50,000<br>1 x 2,500* | 2 x 320,000 |
| | Cliff Quay | Ipswich Corp | 1 x 45,000 | 2 x 365,000 |
| | Rye House | Northmet Power Co | 2 x 30,000<br>2 x 2,000* | 2 x 350,000 |
| | Peterborough | Peterborough Corp | 2 x 20,000 | 3 x 160,000 |
| | Brunswick Wharf | Poplar Metropolitan Borough Council | 3 x 52,500 | 6 x 320,000 |
| | West Ham | West Ham Corp | 1 x 30,000 | 2 x 180,000 |
| South West England & South Wales | Poole | Bournemouth & Poole E S Co | 3 x 50,000 | 6 x 300,000 |
| | Carmarthen Bay | Llanelly & Dist E S Co | 2 x 52,500 | 8 x 175,000 |
| | Plymouth | Plymouth Corp | 2 x 30,000<br>2 x 1,500* | 3 x 320,000 |
| | Llynfi | South Wales E P Co | 2 x 30,000 | 2 x 300,000 |
| | | Total | 2,451,000 | 28,940,000 |
| (a) Canceling a previous direction for: 2 x 50,000-kw sets and 4 x 300,000 lb/hr boilers | | | −100,000 | −1,200,000 |
| (b) Canceling a previous direction for: 1 x 30,000-kw set and 1 x 200,000 lb/hr boiler | | | −30,000 | −200,000 |
| | | Net additional plant | 2,321,000 | 27,540,000 |

* Auxiliary sets

# Gas-Turbine Possibilities in the Stationary Power Plant Field

**Study of gas-turbine economics for power generation in isolated and utility plants. L N Rowley, managing editor, and B G A Skrotzki, associate editor of POWER, show that a substantial, immediate market can be developed for these units***

▶ To DATE, twelve commercial power-producing gas turbines, aggregating more than 80,000 kw, have been built or are on order. All these plants operate at modest inlet-air temperatures and utilize alloy materials that were standard before the war. This record demonstrates that there are definite places in the stationary power field where the gas turbine's inherent characteristics prove very suitable. Moreover, if some of the energy and ingenuity now being expended to raise temperature and efficiency levels were spent in determining those places a substantial immediate market for commercial gas turbines could be developed.

With this general setup in mind, let's review some gas-turbine characteristics to see where they fit in the stationary power plant field. Present economic capacity range for gas turbines using 1100-F gas varies from 1000 to 25,000 kw. When inlet-gas temperatures can be raised the range will increase.

**Physical Characteristics.** Gas turbines can now burn fuel oil and gas. In the light of present aggressive research programs it is likely they will be able to burn coal in the not-too-distant future.

Reports from Switzerland excite considerable interest with the statement that investments in 1100-F gas-turbine plants are 10 to 15% less than comparable-sized high-efficiency steam plants. It seems that this ratio can reasonably be expected to apply in this country.

Gas-turbine plants require only small building volumes, on the order of one third that needed by steam plants of equal capacity. This feature, coupled with the relatively few plant components, means that operating labor can be reduced considerably. Furthermore, gas turbines can be started from cold in six to ten minutes, eliminating banking losses and minimizing starting losses.

Combustion chambers of simple design have high heat releases, running into several million Btu per hr per cu ft. More important, they should be and are easy to maintain. Experience shows turbine and compressor repairs are comparable to steam-turbine maintenance.

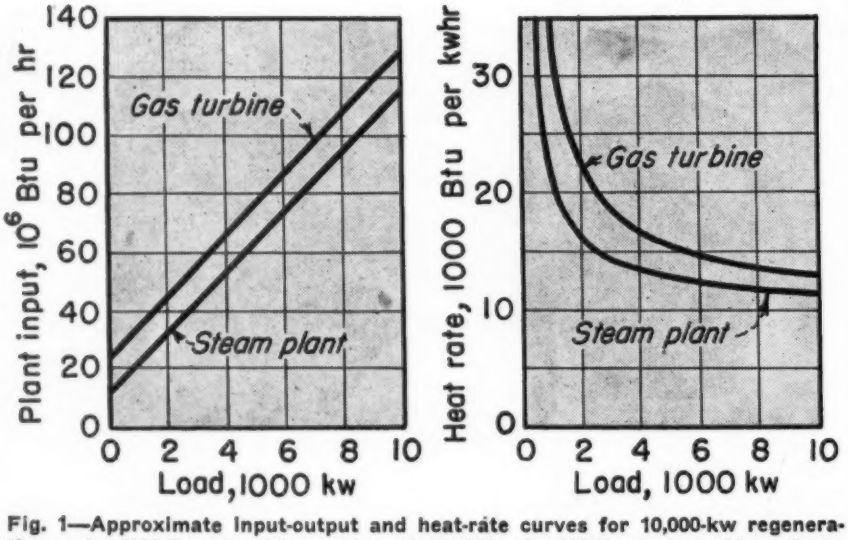



Fig. 1—Approximate input-output and heat-rate curves for 10,000-kw regenerative-cycle 1100-F gas-turbine and modern 800-psig 950-F steam-turbine plants

**Gas-Turbine Performance.** Small physical size and low weight are advantageous in reducing foundation requirements and hence investment costs. For plants of 6000-kw capacity and less, no water is needed, which means the plant can be located anywhere. Plants above 6000-kw capacity have proved more economical when compression is broken into two or more stages and intercooling utilized. This reduces compressor dimensions and raises over-all cycle efficiency and capacity. Water does the intercooling and is only about 20% of that used by a steam plant of equal size. Again, this gives greater latitude of plant location for the gas turbine.

Typical performance at full load with 1100-F inlet gas for 10,000-kw gas turbines are as follows: simple cycle, no intercooling, 19,000 Btu per kwhr; simple cycle with one intercooler, 16,000 Btu per kwhr; 2-turbine arrangement with intercooler, 15,000 Btu per kwhr; regenerative cycle with intercooling and reheating, 13,000 Btu per kwhr.

Because gas turbines are flexible in design, increasing investments produce a more efficient plant. For example, plants built for 30% thermal efficiency, cost about 50% more than plants to operate at 20% thermal efficiency. Any plant built for intermediate efficiency would be roughly prorated in investment cost between these limits.

**Isolated Plant.** With these rough indications of relative performance and operating costs it is interesting to set up some purely speculative figures to aid in arriving at some general conclusions regarding the economic desirability of the gas-turbine plant. Let's compare a 10,000-kw steam plant and gas-turbine plant to serve an isolated load, as shown in Table I. Here a 800-psi 950-F steam plant has been taken to cost $130 per installed kw. This may be argued to be too high in steam conditions compared to most present-day practice for this capacity, and the investment figure as too low. These con-

* Part 1 of a 2-part paper presented before the Midwest Power Conference, Chicago, April 2, 1947.

ditions are, however, deliberately set on the optimistic side to give steam all possible advantage.

In Table I, annual plant factors of 30, 50 and 70% have been considered and the annual average heat rates were derived from Fig. 1 by taking the heat rate corresponding to the average load. Method of arriving at operating costs other than fuel, which includes labor, maintenance, supplies and miscellaneous costs, may be questioned because it is computed as a fixed percentage of the fuel cost. While ordinarily no definite physical relationship exists between these two cost groups, nevertheless, examination of published plant costs analyses shows that they actually tend to be correlated for plants of equal capacity. For the steam plants other operating costs are taken as 0.5 × fuel cost, and for gas-turbine plants as 0.3.

Comparing the absolute values of other-operating costs for the two types shows that the gas-turbine figure runs about 75% of the steam-plant figure. This appears to be a conservative reduction in favor of the gas turbine in light of the smaller attendance needs and expected lower maintenance.

This comparison is made by first computing the total generating cost, including carrying charges for the steam plant. Then from this figure the total operating cost of the gas-turbine plant is subtracted to find how much money is available to pay the carrying charges on the gas-turbine plant. Dividing this money by the 12% carrying-charge rate and the capacity gives the justifiable gas-turbine unit investment that would place it on a par with the steam plant.

Here the last line, Table I, shows that gas-turbine investments, equaling 91 to 98% of the steam-plant investments, places both schemes on a par. Comparing these figures with that of gas turbines reputed to cost 85 to 90% of steam plants, on the basis of Swiss experience, it is evident that gas-turbine plants offer a possible means of producing somewhat cheaper power.

**Adding a Unit** Now let's consider adding a 10,000-kw generating unit to a system with a 100,000-kw peak load and a load duration curve shown in Fig. 2. The existing system has a 100,000-kw capacity and the new unit is needed to reestablish a one-unit reserve. To make a more complete analysis let's study three systems: *A*, *B* and *C* at different stages of efficiency development as shown by their heat rate and incremental-rate curves, Fig. 3. The study results shown in Table II follow the same scheme as Table I, by finding the justifiable investment in the gas-turbine that would place it on a par with steam.

## TABLE I—OPERATION OF ISOLATED 10,000-KW PLANT GAS TURBINE VERSUS STEAM TURBINE

800-psi 950-F steam-plant investment = $130 per kw of capacity
Steam-plant full-load heat rate = 11,600 Btu per kwhr
Gas-turbine full-load heat rate = 13,000 Btu per kwhr
Steam-plant operating cost excluding fuel = 0.5 × steam-plant fuel cost
Gas-turbine operating cost excluding fuel = 0.3 × gas-turbine fuel cost
Investment carrying-charge rate = 12%
Unit fuel cost = 20 cents per $10^6$ Btu

| | | | |
|---|---|---|---|
| Annual plant factor | 30% | 50% | 70% |
| Annual plant generation, mwhr | 26,280 | 43,800 | 61,320 |
| *800-psi 950-F Steam Plant* | | | |
| a. Annual average heat rate, Btu per kwhr | 14,300 | 12,800 | 12,100 |
| b. Annual plant fuel cost | $ 75,200 | $112,000 | $148,000 |
| c. Other operating costs (0.5 × fuel cost) | $ 37,600 | $ 56,000 | $ 74,000 |
| d. Investment carrying charges | $156,000 | $156,000 | $156,000 |
| e. Total annual generating cost | $268,800 | $324,000 | $378,000 |
| *1100-F Regenerative Gas-Turbine Plant* | | | |
| a. Annual average heat rate, Btu per kwhr | 18,700 | 15,400 | 14,000 |
| b. Annual plant-fuel cost | $ 98,200 | $135,000 | $172,000 |
| c. Other operating costs (0.3 × fuel cost) | $ 29,400 | $ 41,000 | $ 52,000 |
| d. Total annual operating costs | $127,600 | $176,000 | $224,000 |
| e. Money available for gas-turbine carrying charges referred to steam plant costs | $141,200 | $148,000 | $154,000 |
| f. Justifiable equivalent investment, per kw | $118 | $123 | $128 |
| g. Justifiable investment, % of steam investment | 91 | 95 | 98 |

In studying the addition of a base-load steam plant the first objective is to determine the reduction in operating cost of the existing system caused by the new unit taking over its share of the load. Here the new unit is assumed to be fully loaded and available and on the line 90% of the time, thus fixing its annual output in item 1. The system average decrement rate comes from (1) integrating the load duration curve, Fig. 2, with the system heat-rate curve. Fig. 3, and (2) subtracting from this the integration of the load curve minus 10,000 kw at all loads with the same heat-rate curves. Dividing the difference of these two integrations by 8760 hr × 10,000 kw gives the values in item 2.

Decrement fuel cost is the product of items 1 and 2. Decrement operating costs of item 3 are taken as 30% of the decrement fuel instead of 50% since experience shows that incremental values are usually less than the ratio of total values on a system consisting of several units. Total reduction in costs of operating existing units appears as item 5. Total generating cost of the new base-load steam plant (including carrying charges) is then subtracted from the existing system decrement costs to find the savings resulting from installation of the new unit. For system *A* the considerable saving indicates the obsolescence of the existing equipment

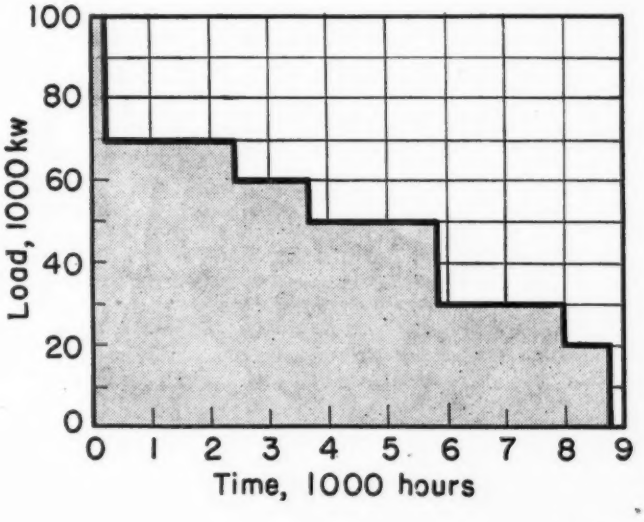



Fig. 2 — System load duration curve having a load factor of 50 percent with high peak loads of relatively short duration

and shows that the new unit should be installed to improve over-all operating economy even if the additional capacity were not needed. For systems *B* and *C* the negative savings indicate the cost of providing the reserve capacity by means of adding an efficient base-load plant.

Next considered is the installation of a simple-cycle 1100-F gas-turbine plant to act purely as a peak-load and standby plant. This requires only a few hours' operation a year during the peak, when it will generate 1752 megawatt hours. The existing system drops an equivalent amount of generation at a high incremental heat rate, obtained from the system increment-rate curve, Fig. 3, corresponding to the averages for the 90- and 100-mw loads. Annual operating costs will then decrease as shown in item 17. These will be replaced by the new operating costs incurred by operating the gas-turbine peak-load plant. The difference of these costs, item 21, is the annual savings realized, excluding the gas-turbine carrying charges. Then comparing the peak-load plant to the base-load steam plant the difference of their annual savings, item 21 — item 11, gives the amount of money available for carrying charges on the peak-load gas-turbine plant.

For system *A* this works out to give —$50 per kw justifiable investment for the gas turbine. This means that besides being given the gas-turbine plant, the system would also have to be given $50 per kw of capacity to end up in the same financial position.

System *B*, however, could afford to pay $73 per kw for the gas turbine or about 56% of the steam-plant cost, which rules out the gas-turbine peak-load application. In system *C*, which is highly developed with very efficient generating units, $140 per kw can be paid for the gas-turbine plant compared to $130 for the steam plant. In this system, the gas-turbine peak-load plant is much better than a base-load steam plant. This brings out the point that peak-load plants can be profitably applied only to systems already operating at high levels of efficiency.

Finally, in Table II, the application of a regenerative gas-turbine is studied as a base-load plant. This is essentially the same problem as that worked out in Table I, except here the plant is operated mostly at full capacity. In other words, the steam plant and gas turbine are directly compared to produce the same annual output. This comparison holds regardless of the remaining system characteristics, that is, whether they are applied to systems *A*, *B* or *C*. An additional influence is studied here, by assuming different levels of operating cost. These are computed with total

## TABLE II—INSTALLATION OF ADDITIONAL 10,000-Kw UNIT ON EXISTING SYSTEM

### COMPARISON OF PEAK-LOAD AND BASE-LOAD GAS TURBINE WITH BASE-LOAD STEAM PLANT, SYSTEM ANNUAL LOAD FACTORS = 50%

| | System A | | System B | | System C | |
|---|---|---|---|---|---|---|
| 1. New base-load unit, annual output mwhr | 78,840 | | 78,840 | | 78,840 | |
| 2. Existing system average decrement heat rate | 24,800 | | 17,000 | | 12,670 | |
| 3. Decrement annual fuel cost at 20¢ per $10^6$ Btu | $391,000 | | $268,000 | | $200,000 | |
| 4. Decrement repairs, labor, supplies at 30% of fuel | 117,000 | | 80,000 | | 60,000 | |
| 5. Total annual decrement cost | | $508,000 | | $348,000 | | $260,000 |
| *New 800-psi 950-F Steam Plant, Base Loaded* | | | | | | |
| 6. New station average heat rate, Btu per kwhr | 11,600 | | | | | |
| 7. New station annual fuel cost at 20¢ per $10^6$ Btu | $183,000 | | | | | |
| 8. New station repairs, labor, supplies at 50% of fuel | 91,000 | | | | | |
| 9. Annual investment charges at 12% | 156,000 | | | | | |
| 10. Total new-station annual generating cost | | $430,000 | | $430,000 | | $430,000 |
| 11. Net annual over-all savings | | $ 78,000 | | —$ 82,000 | | —$170,000 |
| *New 1100-F Peak-Load Gas-Turbine Plant* | | | | | | |
| 12. New station average heat rate, Btu per kwhr | 19,000 | | 19,000 | | 19,000 | |
| 13. Existing system decrement heat rate, Btu per kwhr | 60,000 | | 32,000 | | 24,000 | |
| 14. New unit annual output, mwhr | 1,752 | | 1,752 | | 1,752 | |
| 15. Decrement annual fuel cost at 20¢ per $10^6$ Btu | $21,000 | | $11,000 | | $8,400 | |
| 16. Decrement repairs, labor, supplies at 30% of fuel | 6,000 | | 3,000 | | 2,600 | |
| 17. Total annual decrement cost | | $27,000 | | $14,000 | | $11,000 |
| 18. New station annual fuel cost at 20¢ per $10^6$ Btu | $6,700 | | | | | |
| 19. New station repairs, labor, supplies at 30% of fuel | 2,000 | | | | | |
| 20. New station annual operating cost | | $ 8,700 | | $ 8,700 | | $ 8,700 |
| 21. Net annual savings, excluding new investment charges | | $18,300 | | $ 5,300 | | $ 2,300 |
| 22. Money available for gas-turbine investment charges, referred to steam plant (Item 21)—(Item 11) | | —$59,700 | | $87,300 | | $172,300 |
| 23. Justifiable gas-turbine investment compared to base-load steam plant at 12%, per kw capacity | —$50 | | $73 | | $144 | |
| *New 1100-F Regenerative Gas-Turbine Plant, Base Loaded* | | | | | | |
| 24. New station average heat rate, Btu per kwhr | 13,000 | | | | | |
| 25. New station annual fuel cost at 20¢ per $10^6$ Btu | $205,000 | | | | | |
| 26. New station repairs, labor, supplies at 40% of fuel | 82,000 | | | | | |
| 27. Total new plant operating cost (1.4 × fuel cost) | | $287,000 | | $287,000 | | $287,000 |
| 28. Total new plant operating cost (1.3 × fuel cost) | | $268,000 | | $268,000 | | $268,000 |
| 29. Money available for gas-turbine investment charges referred to steam plant (Item 10)—(Item 27) | | $143,000 | | | | |
| 30. Money available for gas-turbine investment charges referred to steam plant (Item 10)—(Item 28) | | $162,000 | | | | |
| 31. Justifiable investment based on (29), per kw capacity | $119 | | $119 | | $119 | |
| 32. Justifiable investment based on (30) per kw capacity | $135 | | $135 | | $135 | |

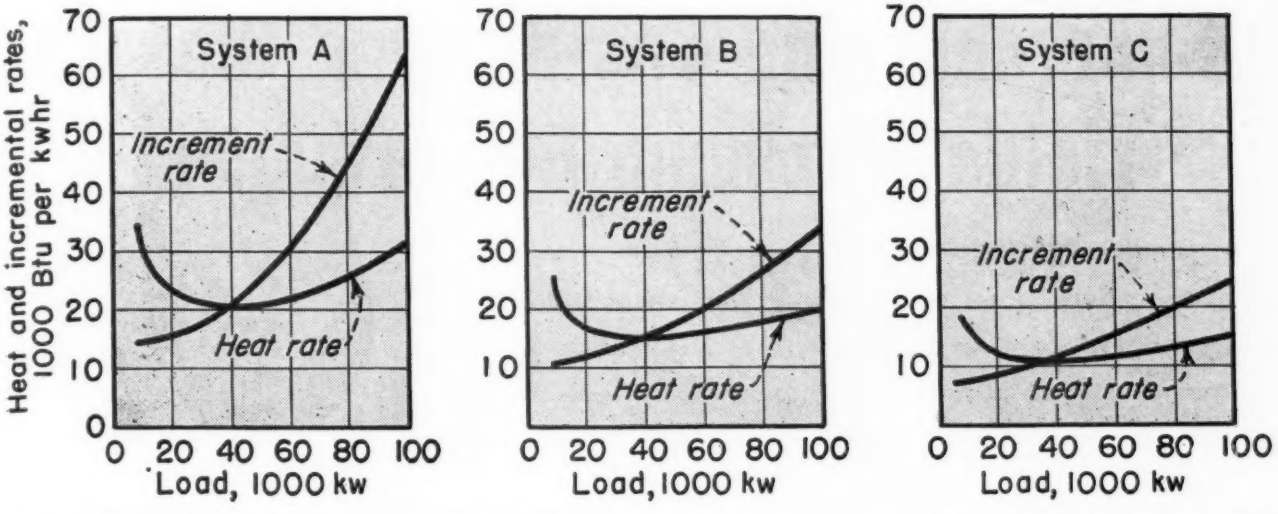



Fig. 3—Examples of typical smoothed heat rate and incremental heat-rate curves, plotted against net system output. A represents system with old low-pressure units; B, typical of present-day systems; C modern h-p plants

gas-turbine operating cost, equaling 1.4 and 1.3 times the fuel cost.

These two ratios make the gas-turbine labor, repair and supplies cost 90 and 68%, respectively, of the comparable figures for the steam plant. Again, both of these ratios are conservative reductions in favor of the gas turbine. The comparable justified gas-turbine investments are then $119 and $135 per kw, or 92 and 103% of the steam-plant investment. Compared with 85 to 90%, from Swiss experience, the gas turbine proves more favorable than steam.

**Transmission Line Booster.** Instances will be found throughout the U. S. where local load centers at the present time can be fed only through long transmission lines because of lack of local water. Gas turbines serve such a situation admirably since they can do without water and are quick starting. Generating capacity at the end of the lines aids in bettering voltage regulation and can serve as back-up capacity during transmission-line failure. Such capacity will also be available to the remainder of the system if it suffers a forced outage at some other time than when the local peak load occurs.

Table III gives a quick picture of the financial advantages of installing a 10,000-kw transmission line, plus a local peak-load 10,000-kw gas-turbine plant to serve a 20,000-kw peak-load demand having a 50% load factor, as compared to providing a 20,000-kw. transmission line. The more costly the transmission line the greater the advantage that accrues to the gas-turbine scheme. Here 30 to 45% more can be spent for a gas turbine than a steam plant whereas gas turbines really cost 10 to 15% less.

Admittedly the figures that are given in Tables I to III are speculative and rough, but they are of an order that is practical. Many related questions that must be answered for any actual system have not been touched. However, all power-system designers should give serious consideration to gas turbines. If they do not, many good bets to achieve minimum-cost power will be overlooked.

*The second part of this article, dealing with industrial applications, will appear in the July issue of* POWER.

## TABLE III—COMPARISON OF 20-Mw TIELINE SUPPLY WITH 10-Mw TIELINE SUPPLEMENTED BY 10-Mw PEAK-LOAD GAS TURBINE AT LOCAL LOAD CENTER

| | | |
|---|---|---|
| 1. Local annual energy requirements, 50% load factor, kwhr | | 87,600,000 |
| 2. Local annual peak load, kw | | 20,000 |
| 3. Transmission-line energy losses, percent | | 10 |
| *Supply From Central-Station High-Pressure Steam Over 20-Mw Tieline* | | |
| 4. Transmission-line investment, dollars per kw | 40 | 60 |
| 5. Allocated plant capacity, kw | 22,000 | 22,000 |
| 6. Allocated plant investment at $130 per kw | $2,860,000 | $2,860,000 |
| 7. Tieline investment | $ 800,000 | $1,200,000 |
| 8. Total investment | $3,660,000 | $4,060,000 |
| 9. Allocated heat rate, Btu per kwhr | 12,800 | 12,800 |
| 10. Annual fuel cost at 20¢ per $10^6$ Btu* | $246,000 | $246,000 |
| 11. Annual total operating cost at 1.5 × fuel cost | $369,000 | $369,000 |
| 12. Total investment carrying charges at 12% | $439,000 | $487,000 |
| 13. Total generation cost including transmission | $808,000 | $856,000 |
| *Supply From 10-Mw Tieline Supplemented by 10-Mw Gas-Turbine Peak Plant* | | |
| 14. Allocated steam-plant capacity, kw | 11,000 | 11,000 |
| 15. Allocated steam-plant investment at $130 per kw | $1,430,000 | $1,430,000 |
| 16. Tieline investment | $ 400,000 | $600,000 |
| 17. Total investment excluding gas-turbine plant | $1,830,000 | $2,030,000 |
| 18. Supply from tieline, kwhr | 74,600,000 | 74,600,000 |
| 19. Supply from gas-turbine peak plant, kwhr | 13,000,000 | 13,000,000 |
| 20. Allocated steam-plant heat rate, Btu per kwhr | 12,800 | 12,800 |
| 21. Gas-turbine plant heat-rate, Btu per kwhr | 19,000 | 19,000 |
| 22. Annual steam-plant fuel cost at 20¢ per $10^6$ Btu* | $210,000 | $210,000 |
| 23. Annual gas-turbine plant fuel cost at 20¢ per $10^6$ Btu | $ 50,000 | $ 50,000 |
| *Annual total operating costs:* | | |
| 24. Steam plant at 1.5 × fuel cost | $315,000 | $315,000 |
| 25. Gas turbine at 1.4 × fuel cost | $ 70,000 | $ 70,000 |
| 26. Steam-plant and tieline investment carrying charges | $220,000 | $244,000 |
| 27. Generation cost excluding gas-turbine carrying charges | $605,000 | $629,000 |
| 28. Money available for gas-turbine carrying charges | $203,000 | $227,000 |
| 29. Justified gas-turbine investment, dollars per kw | 169 | 189 |

* Includes additional generation for 10% tieline energy loss

# Supercharging Gas-Burning Diesel Yields Maximum Performance

**Designed to burn either oil or gas, or mixture of both fuels in any proportions, new 1220-hp engine installed by Lehigh Portland Cement Co at Iola, Kansas, plant has a turbocharger**

▶ TAKING A PIONEER STEP in the application of gas-burning diesel engines, Lehigh Portland Cement Co installed in its Iola, Kansas, plant a 1220-hp unit equipped for supercharging to realize high-bmep and low fuel consumption. The new engine-generator, operating normally on natural gas, adds 840 kw to present plant capacity of 3500 kw.

The 16x22-in. 327-rpm engine, built by Nordberg Mfg Co, follows the mechanical design of that company's 4-cycle oil diesels. It differs only in provisions for burning gas or combinations of oil and gas. Fig. 1 and 2 indicate the general appearance of the totally inclosed construction; cross-section of Fig. 3 shows the mechanical details. Bedplate and frame are combined in a single casting with webbed bridges supporting the main bearings. The one-piece cylinder block carries pressed-in removable cylinder liners. Through-bolts tie together cylinder block and bedplate.

Alloy-cast-iron trunk pistons are oil-cooled by a high-velocity jet spray impinging on the inner surface of the head. Connecting rods carry a bushing at the small end, while the big ends are the marine type, with shim adjustment for compression pressure. Cast-steel crankpin boxes are fitted with renewable steel shells lined with centrifugally cast anti-friction material. Crankshaft is a one-piece forging with journals, webs and pins drilled for oil passage.

A complete circulating system lubricates the engine with the exception of the power cylinders, which are served by a Manzel multi-feed lubricator. In the pressure system, the Tuthill circulating pump takes suction from the sump and forces oil through a Nugent strainer and a Ross oil cooler. A 120-gpm 50-psi-head Roper pump with built-in relief valves serves as standby. From the cooler, lubricating oil enters a header connecting to each main bearing, from whence it flows through drilled passages to the crankpins, and thence through the connecting rods to the wristpins. Other connections supply lube oil to camshaft, rollers, guides, governor, and valve-gear mechanism overhead, thus eliminating hand oiling. A Nugent filter of 4-gpm capacity is installed in the lube-oil line to the turbocharger.

**Oil and Gas Operation.** For operation as an oil diesel, the engine is equipped with a Bosch mechanical-injection system, with independent fuel pumps bolted to the block above the camshaft and adjacent to the cylinders they serve. A Woodward governor acting directly on the fuel pumps regulates speed.

For gas operation, the fuel and air enter the cylinder on the suction stroke and the piston compresses the mixture to full diesel pressure. Characteristics of the mixture are such that the high compression does not cause ignition, and combustion is initiated by the injection of a small quantity of fuel oil, known as pilot oil. (For a comprehensive dis-

Fig. 1—Operating end of engine: Exhaust manifold with pyrometers leads to turbocharger at left. The handwheel proportions gas and oil

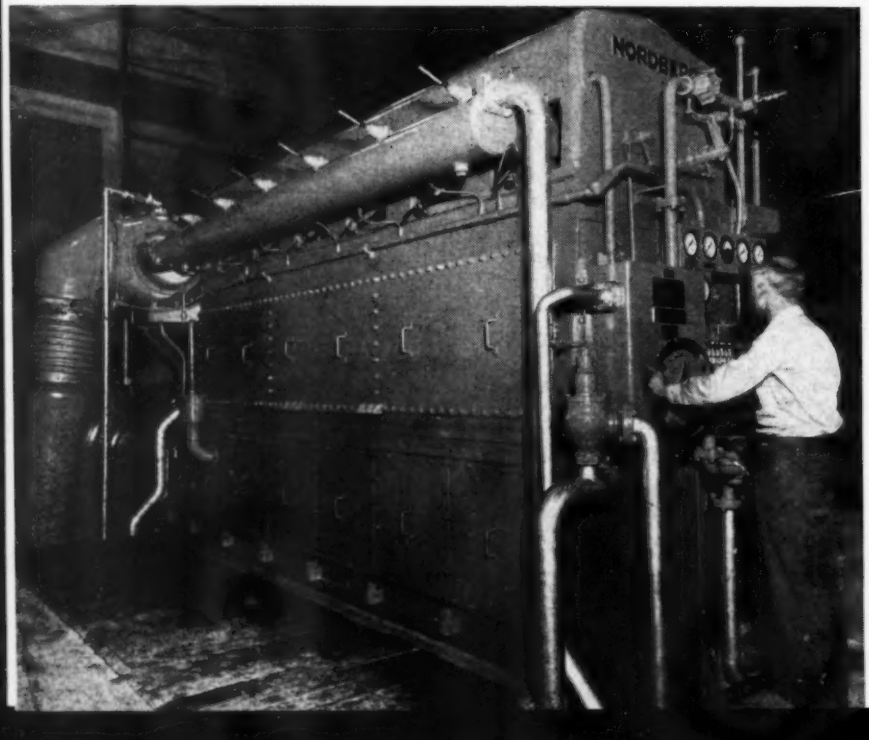
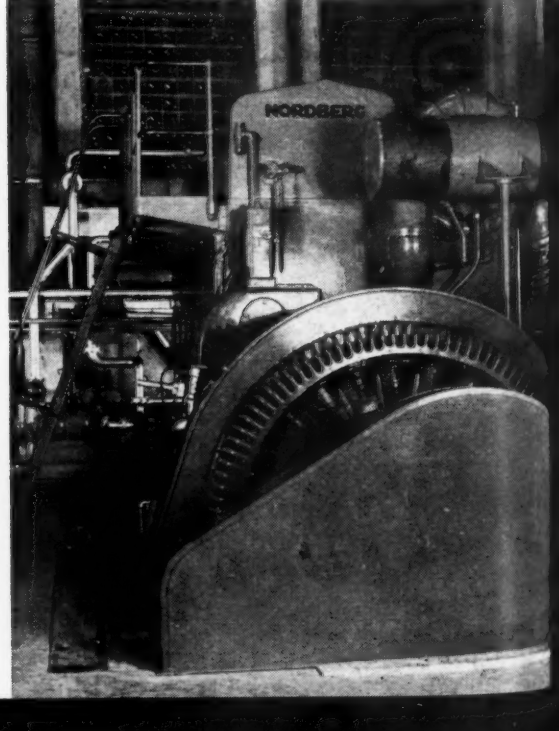


Fig. 2—Generator end: combination silencer and air cleaner in front of the turbocharger



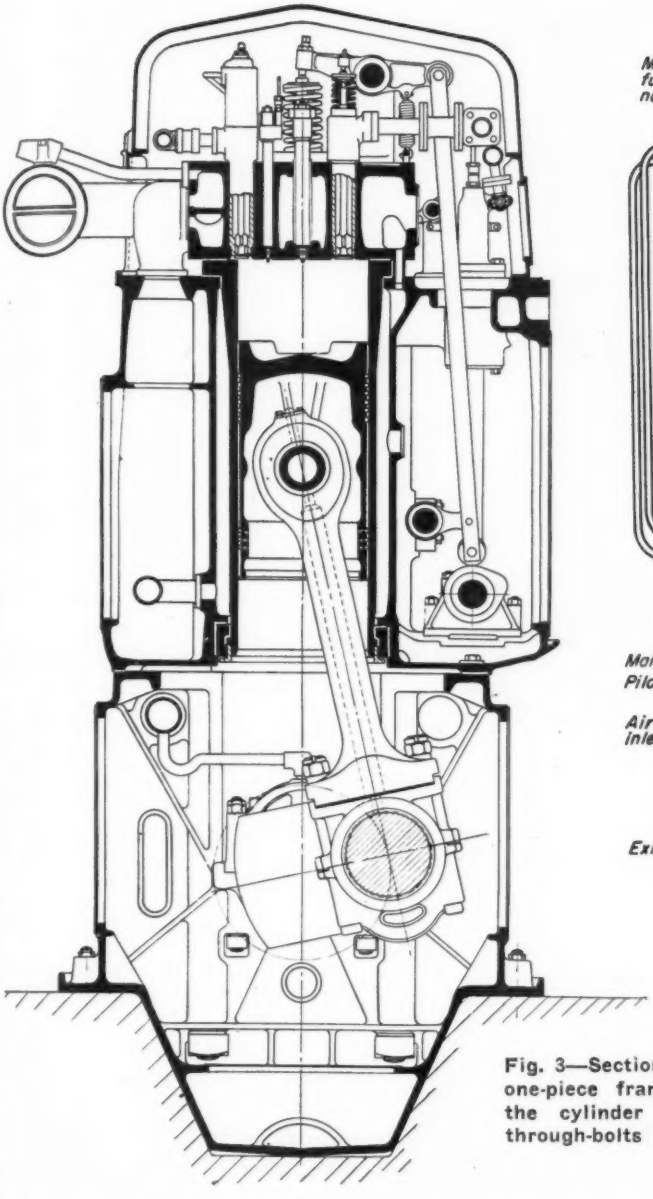


Fig. 3—Section through engine shows one-piece frame and bedplate, with the cylinder block tied to it by through-bolts taking all the tension

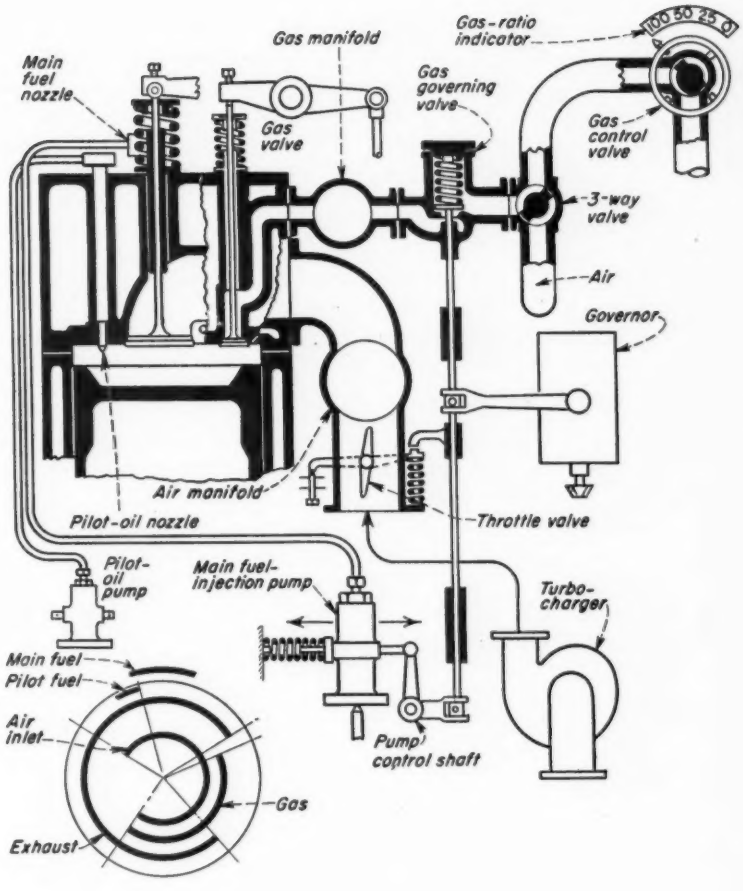



Fig. 4—Diagram above shows fuel system and controls; that at left indicates timing. Note separate pilot-oil pump and nozzle. Gas enters each cylinder under control of gas-admission valve. Gas-regulating valve, governor controlled, adjusts flow to gas manifold. Gas-control valve, upper right, sets ratio of gas to oil in mixture

cussion of burning gas on the diesel cycle, see POWER, May 1945, pp 64-70.)

Fig. 4 shows the fuel and control system for burning gas and mixtures of gas and oil. The Elliott turbocharger discharges to the intake-air manifold, and air enters the cylinders under control of the inlet valves (center in diagram). Separate valves admit fuel gas from its manifold. Operated by a cam mechanism, these gas-admission valves are timed to open after the scavenging period is completed and to close with the air-inlet valves. (See timing diagram at lower left of Fig. 4.) Main gas supply is under control of a governing valve connected to the engine governor. For adjusting proportions of gas and oil in fuel mixtures, a gas-control valve with fuel-ratio indicator is provided. The 3-way valve between the two main-line gas valves admits air to the gas manifold to keep the gas-admission valves cool.

In this type of gas-burning diesel, the designer faces a choice in the means of injecting pilot oil. Maximum simplicity results from using the main pumps and nozzles for this purpose, but equipment built to handle full fuel demand during oil operation cannot be operated satisfactorily at less than about 10% of full-load fuel flow. To permit cutting pilot-oil consumption to 5% or less, the Nordberg Duafuel engine is equipped with a separate pilot-oil injection system, whose pumps and nozzles may be seen in Fig. 4. To avoid need for cooling the pilot-oil nozzles during oil operation, the pilot-oil system operates at all times.

**Controls.** Diagram shows the controls in full-load position for gas operation. Gas enters the governing valve at 8 to 10 psi and, at full load, pressure in the gas manifold is about 6 psi. Air-throttle valve is wide open, as are the gas-governing and gas-regulating valves. Main fuel pumps are shut off. At partial loads, governor arm moves down, reducing gas flow.

If the gas supply fails, or is insufficient to carry the load, the governor arm rises above the position shown, bringing the main fuel pumps into action while the gas valve over-travels beyond the wide-open position. To operate on a gas-oil mixture, gas-control valve is set to the desired fuel proportions, which throttles the gas flow. This has the same effect as a gas deficiency from other causes; governor arm rises to bring the main fuel pumps into play. If load drops under these conditions, the downward motion of the governor arm first cuts down on the oil fuel, then

on the gas fuel. Thus the engine always uses all available gas, and oil fuel makes up the deficiency.

Changeover to operation on oil alone requires only the closing of the gas-regulating valve. Governor arm then rises in response to a tendency to lose speed, bringing the main fuel pumps into action. Air-throttle valve remains wide open when operating on oil. To swing back to full gas operation, the operator merely opens the gas-regulating valve wide. The control wheel for opening or closing the gas-regulating valve, or setting it at an intermediate operating position on a gas-oil mixture, is at the end of the engine opposite the generator, Fig. 1.

**Engine Performance.** Performance of this type engine follows the test curves of Fig. 5, taken on an engine with intercooled supercharging. In normal supercharging, the compression work on the inlet air causes a temperature rise, which means that air entering the cylinder has a density lower than atmospheric air. To a certain extent this increased temperature nullifies the supercharging benefits since the weight of air admitted, which is the important consideration, is less than if it were at atmospheric temperature. In the intercooled system, air from the supercharging blower passes through a cooler, which removes most of the heat of compression, bringing air temperature down close to that at the beginning of compression. Test data of Fig. 5 were taken on an engine in which the air temperature in the inlet manifold was reduced to 90F by such intercooling. The Iola engine is not intercooled, and thus its performance does not quite reach the values shown. Fluctuating load conditions of Iola due to large electric shovels do not permit fuel consumption tests at full load.

As the curves show, operation on gas alone (plus pilot oil for ignition) yields a heat consumption of only 6500 Btu per bhphr at 130 bmep (based on the higher heating value of both gas and pilot oil). This is about 6% less than the best performance on oil alone. It is interesting to note that for oil operation the heat-consumption curve displays the usual flat characteristic of conventional diesels, while on gas the heat-consumption curve rises at partial loads, resembling the characteristic curve of a conventional gas engine operating on the otto cycle. The cause may be that mixture is too lean to burn efficiently or that unburned gas fuel has been lost in the exhaust. Exhaust temperatures are about the same for operation on either gas or oil except at high loads, where exhaust temperature when burning gas is lower because of higher thermal efficiency.

**Auxiliary Equipment.** The photographs, particularly Fig. 6, show the auxiliary equipment at Iola. Intake air enters through a Burgess Manning combination air cleaner and silencer, Fig. 2. Exhaust manifold, which appears plainly in Fig. 1, is watercooled. Exhaust temperatures from individual cylinders can be checked by Alnor pyrometers. Exhaust manifold leads to the turbocharger, which discharges through an inclined pipe fitted with a Zallea flexible connection to an underfloor line leading to the exhaust silencer. This is a Burgess Manning unit, equipped with heating coils for generating steam, Fig. 1 and 2.

Engine-cooling system is the fully closed type. Raw-water pump, an Ingersoll-Rand centrifugal rated 250 gpm at 75-psi suction pressure and 100-psi discharge pressure, takes suction from a main and discharges through the 210-sq-ft Ross oil cooler and the 270-sq-ft Ross jacket-water cooler. Raw water then returns to the main. The jacket-water pump, an Ingersoll-Rand centrifugal rated 250 gpm at 75-ft head, takes suction from a jacket-water standpipe, shown at far left of Fig. 6. The pump discharges to the jacket-water cooler, and thence to the engine. Jacket-water from the engine returns to the standpipe. A Viking alarm system, equipped with a Faraday electric horn, provides protection against low pressure and high temperature on both jacket-water and lubricating-oil systems. Pumps, coolers and piping are shown in Fig. 6, which also shows the Honan-Crane lubricating-oil reclaimer. This unit operates on the continuous-bypass system to maintain oil quality at an acceptable level.

**Fig. 6 (right)—Auxiliaries at operating end of engine include jacket-water cooler (top) and oil cooler (below). At floor level, left to right: starting tanks, jacket-water standpipe, jacket- and raw-water pumps, lube-oil strainer and, at far right, continuous lube-oil purifier**

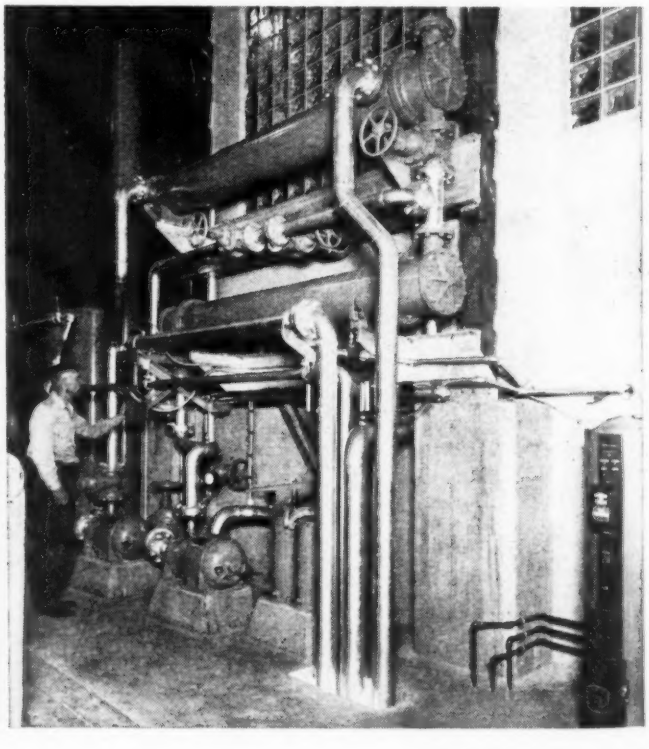
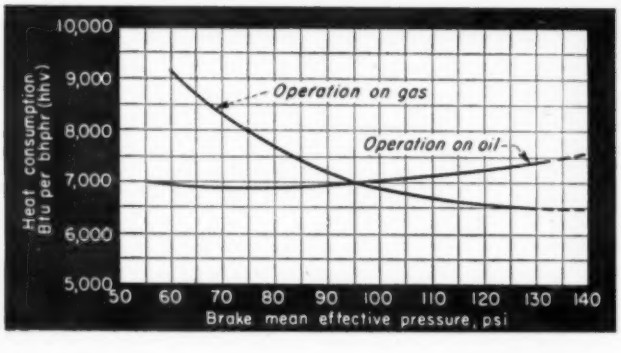


**Fig. 5 (below)—Performance curves for supercharged engine, with intercooling, operating on gas alone (plus pilot oil) and on oil alone. Note that heat consumption curve for oil follows typical diesel characteristic but curve for gas resembles that for otto-cycle gas engine**



# Intelligent Planning Cuts Fuel Loss, Raises Power Factor

**Here's an example of what a laundry accomplished by drawing the right conclusions from facts and figures revealed by intensive survey of plant and factory setup**

By **WILLIAM NOTE**, *Chief Engineer*
*Hessler Laundry Service, Inc*

▶ SEVERAL YEARS AGO our plant introduced a renovation program that continues to provide leads for improving operation. A change from bituminous to anthracite coal, to increase boiler efficiency and reduce smoke, led to purchasing draft and $CO_2$ recorders, damper regulators and turbine-driven forced-draft fans. Draft control was made automatic by connecting the damper regulator to the steam valve on draft-fan turbine. These improvements raised boiler efficiency from 55 to 72%.

**Raises Power Factor.** After installing a kilowatt-hour meter on the generator, plant power factor was found to be 55%. Because laundry load was increasing it was necessary to consider installing a larger compressor to supply air for the presses. This gave us the opportunity to select a synchronous-motor-driven machine which, together with an additional static condenser, raised plant power factor to 78%. Savings repaid the cash outlay in 1½ years, and the improvements increased washing capacity 50%.

Solution of a problem involving flash loss led to the final result of providing automatic boiler water-level control. Flash loss escaped through a 3-in. vent on the condensate tank that collected returns from ironing equipment operating at 135 psi. This condition, together with the opening by laundry operators of trap bypass valves, wasted 20% of our fuel.

We tried saving this heat by piping the flash steam to the 10,000-gal water heater. But this plan did not help matters. It merely overheated the water, as there was already enough engine exhaust steam to heat all the water we required. Using a portion of this exhaust steam for building heating would have made it necessary to repipe the entire system for lower pressure because the heating system requires 20 psi for one section, 65 for another. And it would have been used only part of the year.

**Closed Returns.** Next we installed a closed return system, Fig. 1. This permitted shutting down the boiler feed pump, a 5% saving of the steam generated. The return system operates under 30-psi backpressure, thereby raising the feedwater temperature over 80 F. A connection on top of the condensate receiver, which supplies the return trap, feeds the 20-psi heating system. This

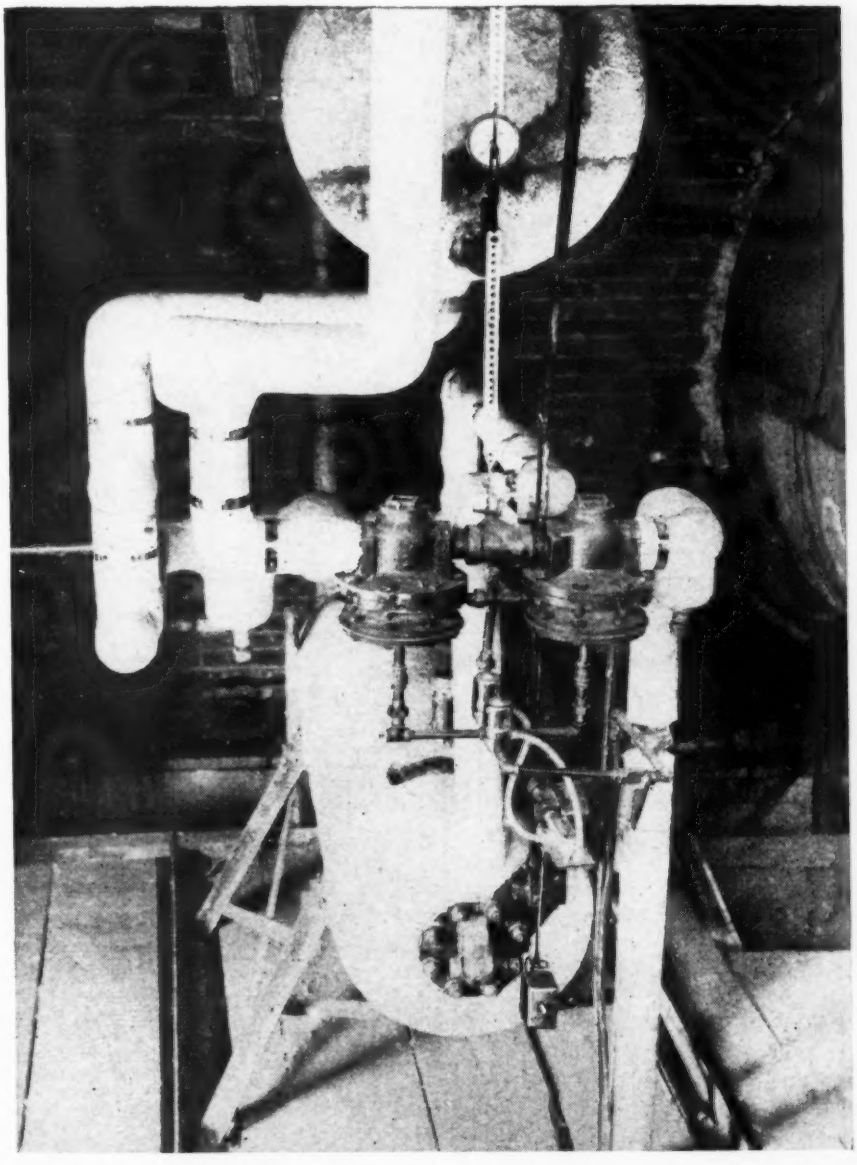


**Fig. 1—Laundry condensate returns to overhead receiver that operates at 30-psi backpressure and that now supplies a feeding return trap for each boiler**

setup still let considerable steam escape from the receiver relief valve.

It was obvious we had not fully solved the problem. So we separated the return lines and piped condensate from the 135-psi system to a flash chamber made from a 6x12-in. nipple and fittings, Fig. 2. Condensate enters at the side and flash steam leaves the top through a 65-psi line feeding unit heaters, driers and dry-cleaning department. Condensate drains from the bottom to a large trap that discharges to a 30-psi line (return line from the 65-psi system that goes to the return-trap receiver). Flash steam in the receiver, under 30-psi pressure, is piped to the 20-psi heating system. The relief valve, set at 30 psi, connects to the exhaust steam coil in the water heater. Low-pressure returns, from the 20-psi heating system and from the water heater, are picked up by a lifting trap, and discharged to the return-trap receiver (boiler feeder).

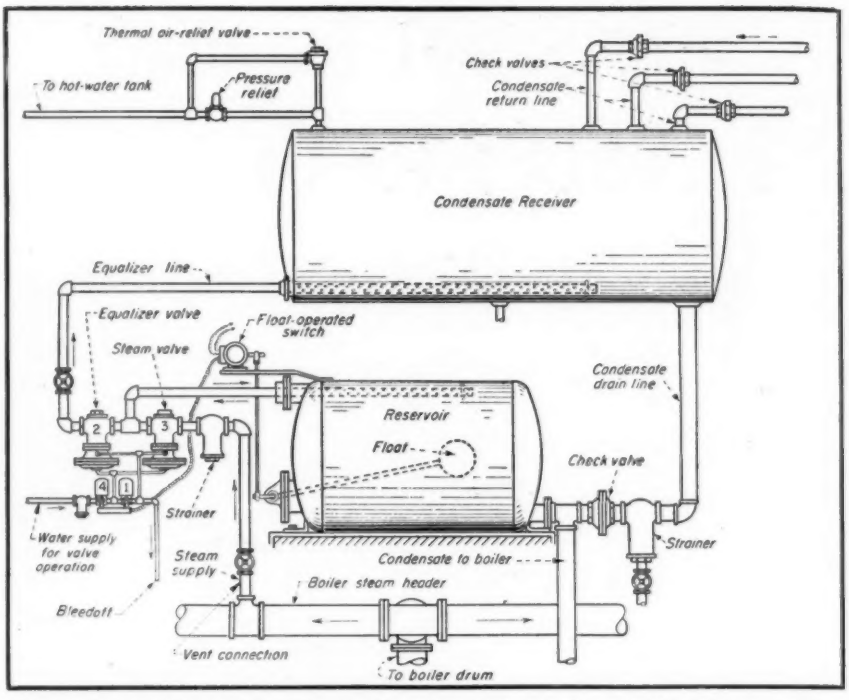



**Fig. 3—Conventional hook-up of return trap takes boiler venting pressure from steam space or main header. Fig. 2 shows tube descending to the water level**

**Water-Level Control.** Makeup water was originally controlled by hand through a closed feedwater heater under 60-psi pressure. About two years ago we installed a second return trap. This makes one for each boiler, but both feed from one receiver. Boiler feeding was made automatic according to water level by installing a tube in each boiler down to the water level desired, Fig. 2. Other end of tube connects to the pressure-equalizing valves on the return trap. Conventional method is to connect the return trap to boiler steam space or header, Fig. 3.

Makeup water was introduced in the bottom of each trap through a check valve to prevent back flow to the 90-psi water supply. In arranging the makeup water supply it was important to have enough pressure to overcome the 30 psi in the system as well as a pipe large enough to supply the amount required. Trick here was to size the line according to amount of makeup needed. This arrangement makes it possible to operate the boilers with water-level fluctuations of less than ½ in. in the gage glass.

All the different pressure systems have reducing valves connected to the main steam supply to keep pressure constant if flash steam is not enough to meet the demand. Also, if more flash steam is available than needed, relief valves relieve the pressure into lower-pressure lines, until the steam finds its way into the exhaust coil in the 10,000-gal water heater. Steam from all sources is then condensed in heating water for the washroom.

**Office Heating System.** Another problem we solved was nonuniform heating in the office space. A homemade temperature-regulating system consisting of thermostat, diaphragm valve and two small solenoid valves was connected to the steam supply. The thermostat, a single-pole double-throw device, makes contact in either position. When no heat is required, one solenoid valve applies water pressure on top of the steam-valve diaphragm and keeps it closed. When heat is required, thermostat trips to the opposite contact. This closes first solenoid valve and opens another that allows the water on top of the diaphragm to leak out. Spring tension under the diaphragm then opens the valve and admits steam to the system. This cycle is repeated as dictated by the thermostat, thereby maintaining the temperature of the office at any desired value. The system has been in service over ten years without repairs.

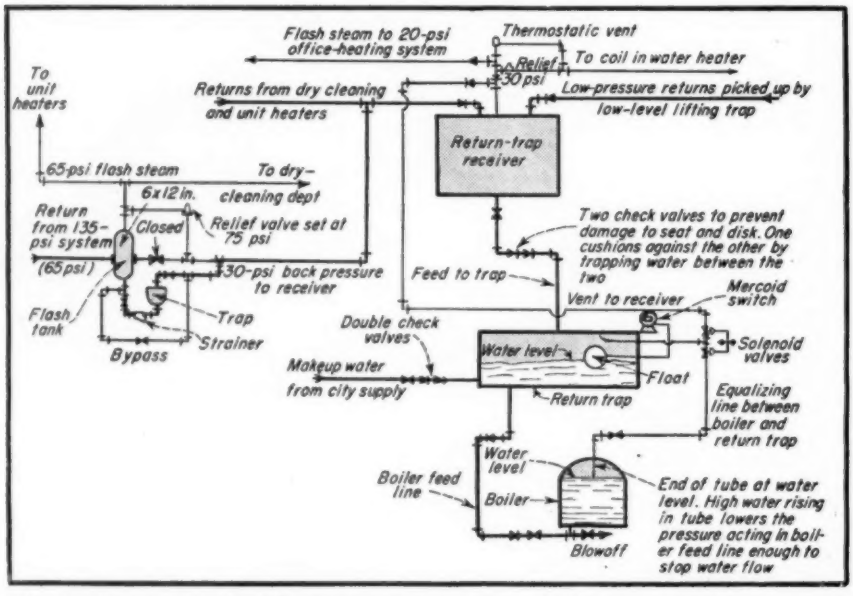

Flash steam to 20-psi office-heating system
Thermostatic vent
Relief 30 psi
To coil in water heater
To unit heaters
Returns from dry cleaning and unit heaters
Low-pressure returns picked up by low-level lifting trap
Return-trap receiver
65-psi flash steam
To dry-cleaning dept
6x12 in.
Return from 135-psi system (65 psi)
Closed
Relief valve set at 75 psi
Two check valves to prevent damage to seat and disk. One cushions against the other by trapping water between the two
30-psi back pressure to receiver
Feed to trap
Vent to receiver
Mercoid switch
Flash tank
Trap
Strainer
Bypass
Double check valves
Solenoid valves
Water level
Makeup water from city supply
Float
Return trap
Equalizing line between boiler and return trap
Water level
Boiler feed line
Boiler
End of tube at water level. High water rising in tube lowers the pressure acting in boiler feed line enough to stop water flow
Blowoff

**Fig. 2—Rearranged piping takes flash steam from high-pressure returns to feed low-pressure systems. Live steam from reducing stations make up the deficit**

# JOHN C PORTER

# A PERSONALITY IN OUR FIELD

**After four years before the mast, four years in college, an adventurous engineer forges ahead to Chief's job in a large textile mill**

Porter soon learned that to be capable an engineer must study continuously even after graduation from college

▶ As POWER ENGINEER for the Rock Hill Printing & Finishing Co, Rock Hill, South Carolina, John C Porter has charge of all power facilities for one of the largest textile printing and finishing plants in this country. His job is to keep the wheels turning by furnishing adequate amounts of water, process steam, compressed air, and electricity for equipment whose capacity is 360 million yards of cloth a year. Normal output of 300 to 320 million yards goes all over the world.

Two 600-v 3600-rpm turbine-generators of 1500- and 2000-kva capacity supply electrical power. To heat dampening water and dry the cloth, turbines, operating at 15-psi backpressure, furnish 150,000 lb per hr of exhaust steam. Steam for turbines and remaining process requirements comes from a 150,000-lb-per-hr pulverized-coal-fired boiler, and six stoker-fired units—three 24,000 lb per hr, one 45,000 and two 56,000.

Interviewed by a POWER editor, Porter reminisced on how, shortly after his arrival, he had installed the pulverized-coal-fired boiler and an economizer. He solved his ash problem by having it trucked to the county roads.

### LIFE ON THE OCEAN

After completing high school in Portsmouth, Virginia, his birthplace, Porter gratified a longing to go to sea by taking a job on a War Department motor boat, running on the Elizabeth River and lower Chesapeake Bay. This gave him excellent experience starting balky gasoline engines, but after looking at the same scenery for a year, he decided to ask for a transfer.

At that time, the Government was operating the old *Chinook*, in Norfolk Harbor. It was the world's largest hopper dredge, and Porter transferred to it as an oiler, later rising to water tender. This was really excellent experience in the line he was to follow, but after passing the same shore line for two years, John decided to hunt new scenery.

He soon landed a job with Eastern Steamship Lines (Old Dominion Line then) as water tender on a passenger ship between Norfolk and New York. O Boy! Now he was going places—one day in the country, a night in New York, a night and day at sea, a day and night in Norfolk, and back to sea again. But after a few months the glamour wore off and he quit the long-distance ferryboat. He had lost all interest in boats and travel.

Falling back on his gasoline experience he went to work in a garage. This was the summer of 1924 when he had been out of high school four years, and he realized the need for more education. In the fall he matriculated at Virginia Polytechnic Institute in Blacksburg in the school of mechanical engineering. During summer vacations he again worked on the *Chinook*, and after passing an examination obtained a license as marine engineer. He was graduated from the Institute with a BS in mechanical engineering in 1928, majoring in power-plant engineering.

The day after graduation, fearing some other cadet might step in, he married a girl who lived near the college. They went to Saltville, Va., where John took a job with the Mathieson Alkali Works, Inc. The company had set up a study course, whereby a new man worked a month in each department to develop his capabilities. From this trial, Porter landed on a lime-kiln test. He might be there now, but he sort of let it be noised around that he was a pretty good steam engineer. So at the end of four months he transferred to the power department as foreman with a $25 monthly raise. Of course he was happy about the new job, but he needed more knowledge of electricity. He remedied this by taking a correspondence course.

The power department was large and had a variety of equipment. During his twelve years, the last six as superintendent of power, Porter had experience with five different types of boilers, hand firing, three types of underfeed stokers, two types of pulverized-coal-firing equipment; engine generators, high- and low-pressure turbine-generators, high- and low-pressure boilers, compressors, pumps, motors, small engines, coal conveyors, etc.

In 1940 he decided to take his present position as power engineer with the Rock Hill Printing & Finishing Co. Since his company did no building during the war, he spent all his time keeping the plant running in the face of shortages in man-power and parts, delays in delivery, and coal strikes. Naturally he is proud that he kept the wheels turning without serious shutdowns. He looks forward now to better times when he can plan his work for the future.

# Riley's determination to make every job a show job, has certainly paid dividends . . .

## dividends both to Riley Users and to Riley

Dividends to Riley users because, together with the broad engineering experience and excellent manufacturing facilities, it assures the purchaser steam generating equipment which will give satisfactory continuous operation at efficiencies and capacities which almost invariably exceed guarantees.

To Riley Stoker Corporation by creating a host of enthusiastic Riley boosters and a tremendous increase in Riley sales, carrying Riley to a position of leadership in the boiler industry.

Riley management has maintained an absolutely inviolate policy to its engineering department—"regardless of the equipment specified in the contract or of costs, furnish only a unit which will adequately meet all contract conditions—it is imperative that each new job result in another satisfied Riley user."

Because of the complete satisfaction being obtained from Riley units, almost every Riley user has repeated for more Riley boilers when additional equipment was installed. Riley users know they can rely on Riley. If you select Riley equipment you will be glad of your choice for many years to come.

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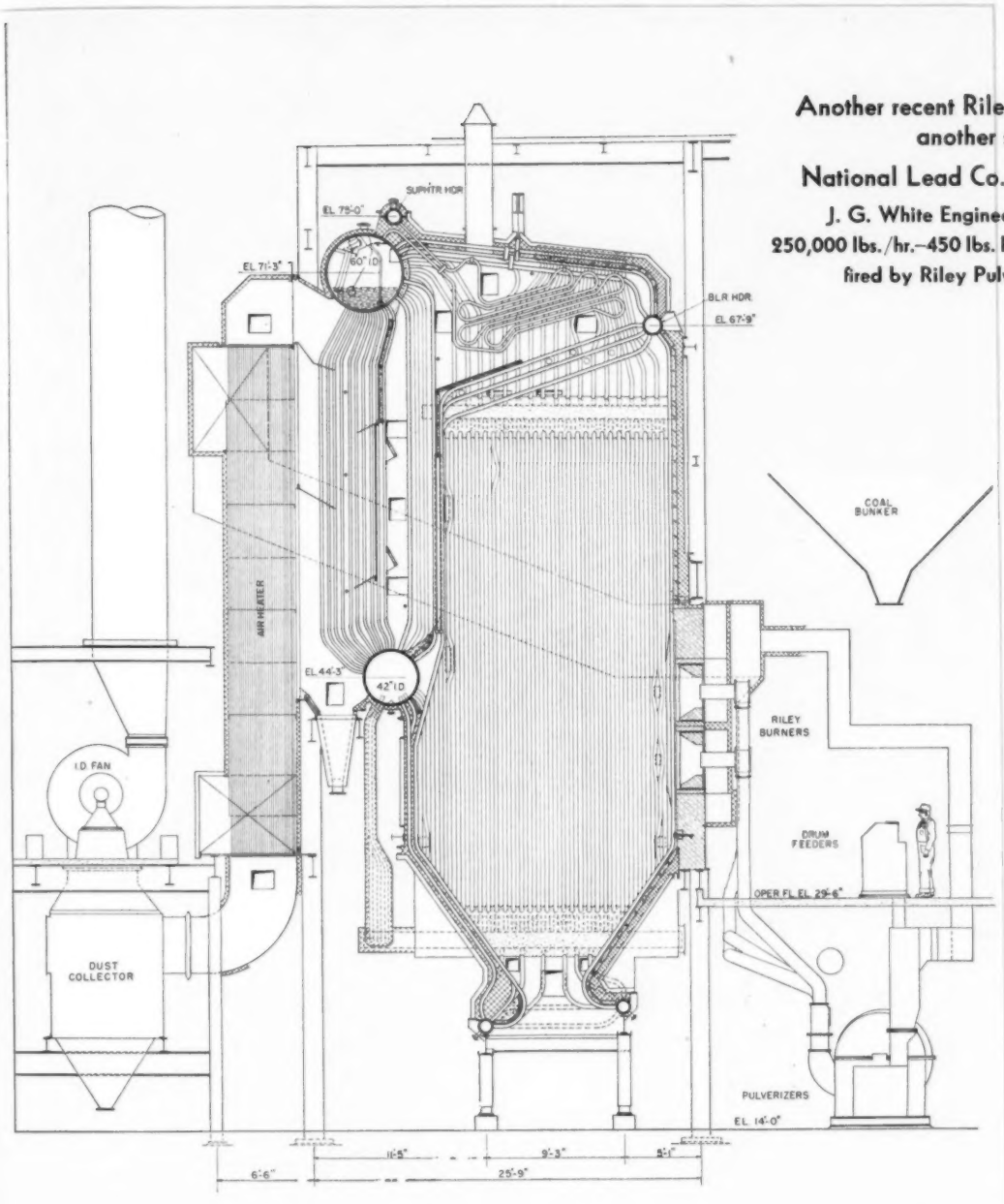


**Another recent Riley repeat order . . . . another show job.**

**National Lead Co. — Sayreville, N. J.**

**J. G. White Engineering Corp., *Engineers***

**250,000 lbs./hr.–450 lbs. Pressure–637°F. Temperature**

**fired by Riley Pulverizers and Burners.**

## All of these well-known companies have recently placed repeat orders for more Riley units

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|---|---|---|
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| Carbide & Carbon Chemicals Corp. | Norton Company | Central Ohio Light & Power Co. |
| Swift & Co. | Gulf Power Co. | Beechnut Packing Co. |
| American Cyanamid Co. | Pennsylvania Salt Co. | Modine Mfg. Co. |
| Houston Lighting & Power Co. | Walford Paper Products Co. | Bemis Bros. Bag Co. |
| Celanese Corp. of America | Container Corp. of America | Dow Chemical Co. |
| Iowa Illinois Gas & Electric Co. | Nicholson File Co. | Central Illinois Light Co. |
| Great Lakes Steel Corp. | Gaylord Container Corp. | Otter Tail Power Co. |
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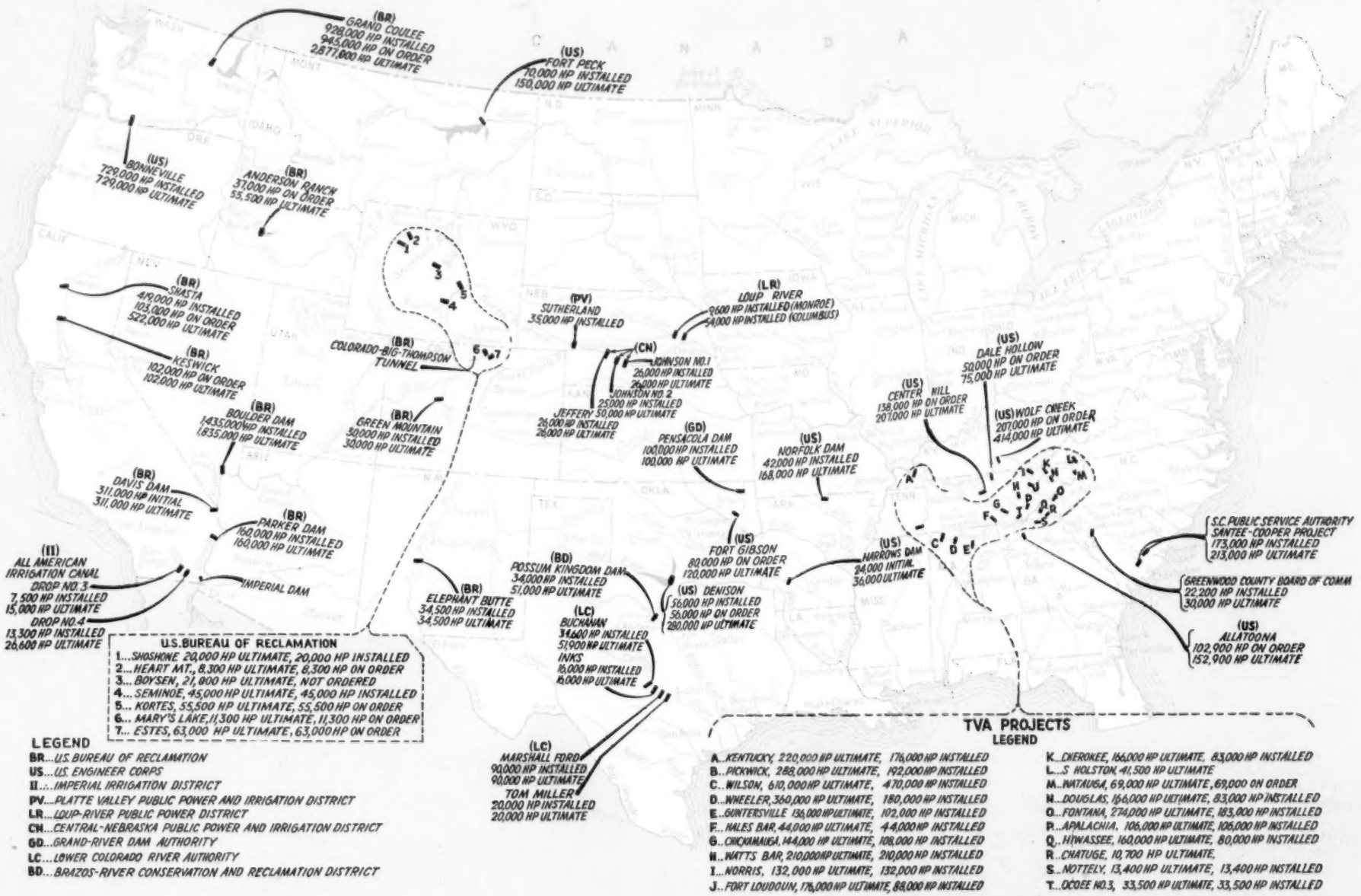
# Location and Capacity of Government Hydro Projects


(BR) GRAND COULEE 928,000 HP INSTALLED 945,000 HP ON ORDER 2,877,000 HP ULTIMATE
(US) FORT PECK 70,000 HP INSTALLED 150,000 HP ULTIMATE
(US) BONNEVILLE 729,000 HP INSTALLED 729,000 HP ULTIMATE
(BR) ANDERSON RANCH 37,000 HP ON ORDER 55,500 HP ULTIMATE
(BR) SHASTA 419,000 HP INSTALLED 103,000 HP ON ORDER 522,000 HP ULTIMATE
(BR) KESWICK 102,000 HP ON ORDER 102,000 HP ULTIMATE
(BR) COLORADO-BIG-THOMPSON TUNNEL
(BR) BOULDER DAM 1435,000 HP INSTALLED 1,835,000 HP ULTIMATE
(BR) GREEN MOUNTAIN 50,000 HP INSTALLED 30,000 HP ULTIMATE
(BR) DAVIS DAM 311,000 HP INITIAL 311,000 HP ULTIMATE
(BR) PARKER DAM 160,000 HP INSTALLED 160,000 HP ULTIMATE
(II) ALL AMERICAN IRRIGATION CANAL
DROP NO. 3 7,500 HP INSTALLED 15,000 HP ULTIMATE
DROP NO. 4 13,300 HP INSTALLED 26,600 HP ULTIMATE
IMPERIAL DAM
(BR) ELEPHANT BUTTE 34,500 HP INSTALLED 34,500 HP ULTIMATE
(PV) SUTHERLAND 35,000 HP INSTALLED
(LR) LOUP RIVER 9,600 HP INSTALLED (MONROE) 14,000 HP INSTALLED (COLUMBUS)
(CN) JOHNSON NO. 1 26,000 HP INSTALLED 26,000 HP ULTIMATE
JOHNSON NO. 2 25,000 HP INSTALLED 50,000 HP ULTIMATE
JEFFERY 26,000 HP INSTALLED 26,000 HP ULTIMATE
(GD) PENSACOLA DAM 100,000 HP INSTALLED 100,000 HP ULTIMATE
(US) NORFOLK DAM 42,000 HP INSTALLED 168,000 HP ULTIMATE
(BD) POSSUM KINGDOM DAM 34,000 HP INSTALLED 51,000 HP ULTIMATE
(LC) BUCHANAN 34,600 HP INSTALLED 51,900 HP ULTIMATE
INKS 16,000 HP INSTALLED 16,000 HP ULTIMATE
(LC) MARSHALL FORD 90,000 HP INSTALLED 90,000 HP ULTIMATE
TOM MILLER 20,000 HP INSTALLED 20,000 HP ULTIMATE
(US) FORT GIBSON 80,000 HP ON ORDER 120,000 HP ULTIMATE
(US) DENISON 56,000 HP INSTALLED 56,000 HP ON ORDER 280,000 HP ULTIMATE
(US) NARROWS DAM 24,000 INITIAL 36,000 ULTIMATE
(US) DALE HOLLOW 50,000 HP ON ORDER 75,000 HP ULTIMATE
(US) CENTER HILL 138,000 HP ON ORDER 207,000 HP ULTIMATE
(US) WOLF CREEK 207,000 HP ON ORDER 414,000 HP ULTIMATE
S.C. PUBLIC SERVICE AUTHORITY SANTEE-COOPER PROJECT 173,000 HP INSTALLED 213,000 HP ULTIMATE
GREENWOOD COUNTY BOARD OF COMM 22,200 HP INSTALLED 30,000 HP ULTIMATE
(US) ALLATOONA 102,900 HP ON ORDER 152,900 HP ULTIMATE
U.S. BUREAU OF RECLAMATION
1...SHOSHONE 20,000 HP ULTIMATE, 20,000 HP INSTALLED
2...HEART MT., 8,300 HP ULTIMATE, 8,300 HP ON ORDER
3...BOYSEN, 21,000 HP ULTIMATE, NOT ORDERED
4...SEMINOE, 45,000 HP ULTIMATE, 45,000 HP INSTALLED
5...KORTES, 55,500 HP ULTIMATE, 55,500 HP ON ORDER
6...MARY'S LAKE, 11,300 HP ULTIMATE, 11,300 HP ON ORDER
7...ESTES, 63,000 HP ULTIMATE, 63,000 HP ON ORDER
LEGEND
BR...U.S. BUREAU OF RECLAMATION
US...U.S. ENGINEER CORPS
II...IMPERIAL IRRIGATION DISTRICT
PV...PLATTE VALLEY PUBLIC POWER AND IRRIGATION DISTRICT
LR...LOUP-RIVER PUBLIC POWER DISTRICT
CN...CENTRAL-NEBRASKA PUBLIC POWER AND IRRIGATION DISTRICT
GD...GRAND-RIVER DAM AUTHORITY
LC...LOWER COLORADO RIVER AUTHORITY
BD...BRAZOS-RIVER CONSERVATION AND RECLAMATION DISTRICT
TVA PROJECTS
LEGEND
A...KENTUCKY, 220,000 HP ULTIMATE, 176,000 HP INSTALLED
B...PICKWICK, 288,000 HP ULTIMATE, 192,000 HP INSTALLED
C...WILSON, 610,000 HP ULTIMATE, 470,000 HP INSTALLED
D...WHEELER, 360,000 HP ULTIMATE, 180,000 HP INSTALLED
E...GUNTERSVILLE 136,000 HP ULTIMATE, 102,000 HP INSTALLED
F...HALES BAR, 44,000 HP ULTIMATE, 44,000 HP INSTALLED
G...CHICKAMAUGA, 144,000 HP ULTIMATE, 108,000 HP INSTALLED
H...WATTS BAR, 210,000 HP ULTIMATE, 210,000 HP INSTALLED
I...NORRIS, 132,000 HP ULTIMATE, 132,000 HP INSTALLED
J...FORT LOUDOUN, 176,000 HP ULTIMATE, 88,000 HP INSTALLED
K...CHEROKEE, 166,000 HP ULTIMATE, 83,000 HP INSTALLED
L...S HOLSTON, 41,500 HP ULTIMATE
M...WATAUGA, 69,000 HP ULTIMATE, 69,000 ON ORDER
N...DOUGLAS, 166,000 HP ULTIMATE, 83,000 HP INSTALLED
O...FONTANA, 274,000 HP ULTIMATE, 183,000 HP INSTALLED
P...APALACHIA, 106,000 HP ULTIMATE, 106,000 HP INSTALLED
Q...HIWASSEE, 160,000 HP ULTIMATE, 80,000 HP INSTALLED
R...CHATUGE, 10,700 HP ULTIMATE,
S...NOTTELY, 13,400 HP ULTIMATE, 13,400 HP INSTALLED
T...OCOEE NO. 3, 33,500 HP ULTIMATE, 33,500 HP INSTALLED

# WORLD LEADERSHIP...

## Our Duty and Our Opportunity

CAPITALISM in Europe and the rest of the world is challenged by a real and formidable rival, communism. For capitalism to thrive a reasonable amount of prosperity is essential. Communism uses poverty to advance itself.

Except for the Western Hemisphere, most of the world came out of the war poor. Two years after V-E Day it is still poor. It needs dollars. It needs credit. It needs capital. It needs trade. It needs technical and managerial skills.

If we in America are to help the rest of the world back to its feet, starting it again on the road to peace and a free economy, we should try to supply those needs within the limits of our capacity.

We must not overtax our own strength. For the first requirement of a stable world is a strong United States. But we must accept leadership in international economic recovery—in our own self-interest.

What can the United States do to help men back to prosperity in a world economy which will allow them *freedom and incentive*? There are many things. But here are two of the most important:

1. The United States, through Congress, must determine the pattern and the total of the foreign loans or grants it can afford. We must answer three questions. How much will the new program cost? Can we afford it? Have we the technicians and managers to watch the loans, assuring their fruitful use?
2. We must demonstrate that we do not intend to raise our tariff walls to prohibitive heights when our debtors begin to repay us in goods and services, which is the only practical way they can pay us. Otherwise our loans will become losses.

If the United States is to meet even the minimum requirements of world rehabilitation, Congress eventually must authorize more advances than those to Greece and Turkey. The $400 million for those two countries will not do the over-all job of political and economic defense which we have begun. A minimum of $5 billion, if promptly and wisely applied in eight to ten countries, might suffice. BUT this $5 billion will be on top of approximately $16.8 billion which we have spent or earmarked during the past two years for use abroad, including our full share of the World Bank and Fund. We shall do a faster and more effective job if Congress will thus add up the foreseeable total of our international aid, and, even though the total looks imposingly large, commit us to it, with proper collateral safeguards from the debtor nations.

Congress need not try to foretell all contingencies, like last winter's weather in Britain, and it certainly should not create the impression that nations need only ask for billions to receive them. On the other hand, the war should have taught us the miserable consequences of "too little and too late." The President should have learned that he engenders skepticism by going to Congress with parts of a program, as he has done in the British, Grecian and Turkish loans. Within the limits of our capacity, we must make the decision now to see the whole job through—or throw in the sponge.

In the interest of the debtor nations—as well as in our own interest—the loan program should be hard-boiled. Rehabilitation loans must really rehabilitate. They must produce a state of economic health which will permit the World Bank and private capital to take over the task of financing world recovery—as perhaps can be done today in France and the Low Countries.

The loans, therefore, must be within the limits of our technical and managerial ability to implement them. Without technical help, Greece can not use its loan effectively—to rebuild railroads, clear ports, revive agriculture. Without skilled supervisors, Germany can not be made to pay its way. Money alone won't pull China from the brink of economic chaos.

Our lending calls for more than money. It calls for trained personnel to help the recipients utilize the loans effectively—geologists, construction and sanitary engineers, monetary experts, and management and agricultural specialists.

Loans are necessary but they are only a first step. A long-range program requires the opening of the half-closed doors of world trade—our own door, too.

We will have to get used to the idea that, when our debtors pay us, they must pay us largely in goods and services. Refusal to permit such repayments in the twenties helped start the world depression in the thirties—and the loss of our investments. *Imports do tend to raise living standards, and a two-way trade program need not require us to slash our present tariff rates.*

The complexion of our foreign trade has changed since the war. Our manufacturing capacity has increased and our raw-material self-sufficiency is tending to decline. For example, we probably shall have to continue importing copper and zinc and to increase our prewar dependence on imported lead. We may soon have to depend heavily on imported oil, and—gradually—on a growing volume of iron ore from abroad. Our normal dependence on imports for commodities like rubber, tin and silk will continue.

Our population has gone up 10 million in the last decade, and we now have a $176 billion national income, making room for more imports.

As a result of every nation's recent attempts to make itself secure and self-sufficient by slamming its trade door, a world-wide series of quotas and restrictions is blocking international trade. Even more, government buying and selling threaten to take commerce out of the hands of private traders, placing it in the uninspired care of bureaucratic negotiators.

Our government has taken the lead in calling the conference of 18 nations, now meeting at Geneva, to open as many trade doors as possible. The American delegates will bargain product by product and country by country—all summer, if necessary—for lower tariffs, fewer quotas and a free flow of *private* trade. The task is a long one, and the results are as yet uncertain, but, if success is achieved, an immense opportunity for good works and good earnings will lie before American businessmen.

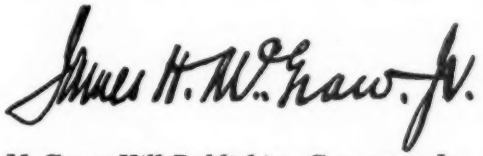
This is no picayunish opportunity. Authoritative estimates put our 1947 exports at $11 billion and our imports at $6 billion. That's substantial. It is greater than the value of all crops grown on our farms ($10½ billion) and exceeds the value of all shipments of industries such as automobiles ($9 billion), textiles ($8 billion) and chemicals ($8 billion).

International trade is vital, not to be shrugged off, not to be kicked around as a football of party politics. Republicans and Democrats agree on a non-partisan foreign *political* policy. They should agree also on a non-partisan foreign *economic* policy. The foreign relations of the United States, political or economic, can no longer be log-rolled hither and yon.

A general program for international recovery, outlined here, will bring its full quota of aches and pains. But lack of a program will produce economic and political troubles on a vast scale; timid retreat will invite economic disaster and war.

By an intelligent, bold and resourceful program, we have a chance to win through to a long peace in the kind of world we want. *Unless America provides the leadership, there can be no such program.* Then Communism merely needs to hang around long enough to pick up the pieces.

Ours is the responsibility and the opportunity.



*President McGraw-Hill Publishing Company, Inc.*


## A NEW ENTERPRISE

Advocacy by the McGraw-Hill Publishing Company, in the accompanying editorial, of an effective world economic policy is not a mere verbal exercise. In the faith that we as a nation shall develop such a policy, this Company, following a trail blazed by leaders in American industry and finance, is expanding its operations overseas.

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# Vacuum Deaeration Rids Cold Water Of Dissolved Gas: Saves Pipelines

**Here's one way to keep your pipe capacity up and pumping costs down, and to reduce leaks. Remove dissolved gas from cold water before it enters the distribution lines***

By SHEPPARD T POWELL
*Consulting Chemical Engineer*

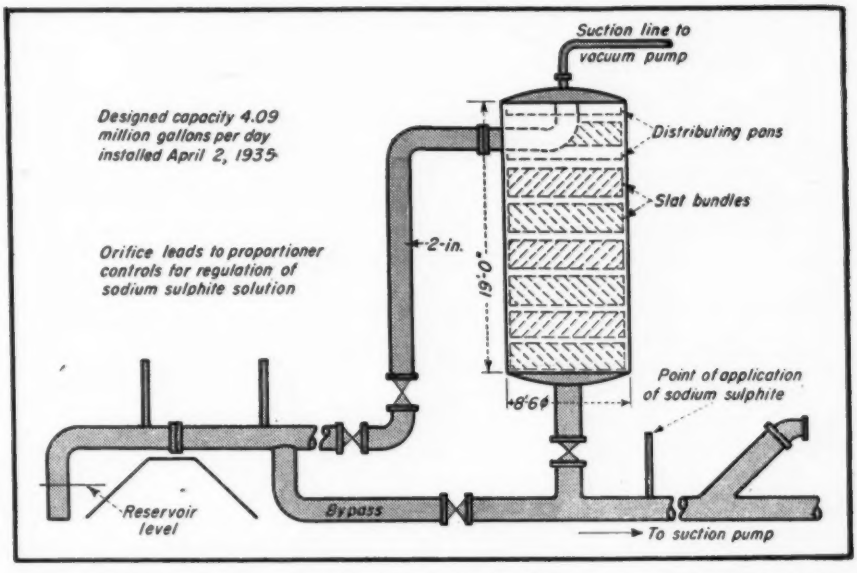


**Fig. 1—Water, delivered at the top and distributed over perforated plates, falls vertically through a series of slat bundles to a storage reservoir below**

▶ OF THE OBJECTIONABLE GASES that influence corrosion of both ferrous and nonferrous equipment handling cold water, the commonest are dissolved oxygen and carbon dioxide. Sometimes hydrogen sulphide and other products of decomposition are encountered. Although it has long been known that removal of these dissolved gases greatly reduces a water's corrosive properties, degasification of large volumes of cold water received little or no attention until a comparatively short time ago.

Back in 1935, the Freeport Sulphur Co, Port Sulphur, La., installed this country's first large cold-water deaerator (4 million gal a day) to degasify Mississippi River water. The system, which has been in constant use, delivers water through a 10-mile welded-steel pipeline. Construction is such that protective coating could not be applied to the inside surface.

Only 129 days after operations started, extensive tuberculation from active corrosion decreased pipeline capacity to 3,200,000 gal a day, a reduction of 22%. Because pitting at some places had penetrated more than 8% of wall thickness, corrective measures had to be taken to inhibit the corrosion and restore the line's original capacity.

After investigating several possibilities, a vacuum deaerator, Fig. 1, was designed to remove dissolved oxygen. Cold water, delivered to the top of the deaerator and distributed over perforated plates, falls vertically through a series of slat bundles to a storage reservoir at the bottom. Sodium sulphite is injected into the outgoing water to complete the removal of dissolved oxygen. A 28- to 28½-in. vacuum is maintained in the deaerator by an 18x7-in. dry-vacuum pump, having an over-all efficiency of 39%. The vacuum created draws water into the deaerator direct from the reservoir supplying the pipeline. Slat bundles have proved much simpler and less costly than perforated plates used in an Australian unit.

**Typical Deaerator.** Selection and design depend on the amount of gas to be removed, physical characteristics of the collection and distribution system, and economics involved in providing such facilities. Fig. 2 shows slat packing, distributor trays, vapor take-off, and controls for a large deaerating unit designed to treat corrosive water for a copper mine in Arizona.

Cold water enters near the top and is distributed uniformly over the cross-sectional area before falling vertically through a series of slat bundles to the storage basin below. Vapor line leaving the top of the unit is baffled to minimize carryover of liquid water.

**Performance Data.** Relationship of deaerator pressure, residual oxygen in the effluent, and temperature of the entering water can be illustrated with curves. Information has been calculated from data on oxygen and nitrogen solubility under known conditions of pressure and temperature. Therefore, the curves represent equilibrium conditions that can never quite be realized in a large-scale unit. In practice, however, the results are close enough to these curves to justify their use.

To simplify the presentation, assume that the water to be degasified is saturated with oxygen and nitrogen when entering the deaerator. This condition imposes the greatest load and is a limiting factor in the design procedure. Another assumption is that the water temperature does not change during degasification. Actually, however, temperature decreases three to five degrees when deaerators operate under normal outdoor conditions. So the magnitude of the correction for this factor depends upon how nearly the water is saturated with dissolved gas, temperature of the fluid, and the vacuum maintained.

Other basic assumptions that must

* Abstract of a paper delivered at the Water Conference of the Engineers' Society of Western Pennsylvania, Oct. 1945.

be made when designing such equipment and evaluating the potential efficiency are:

1. Maintain sufficiently low flow rate of the liquid in terms of gal per sq ft of cross-sectional area, to prevent flooding the packing.

2. Have packing deep enough to provide time for equilibrium to be reached or closely approximated.

3. Space the packing properly to effect good distribution. Its design should prevent channeling.

4. Provide pipelines of adequate size to remove the vapors, with minimum pressure drop.

In evaluating these curves remember they are not intended to serve as a complete basis for design. But they do indicate performance and show the range of variables met in practice. Properly used, they aid in controlling the operation and minimizing the number of control tests necessary for best operation. They also define the limiting conditions that the equipment must meet for any particular installation.

Fig. 3 shows the absolute pressure that a deaerator has to maintain at 68 F to obtain various, desired oxygen residuals in the degasified effluent. Normally deaerator pressure is the result of three variable pressures that are exerted by oxygen, nitrogen and water vapor. Their sum represents absolute pressure in the deaerator. In certain instances, carbon dioxide, hydrogen sulphide and other gases make up a portion of the total pressure.

Curves in Fig. 4 show the relationship between deaerator absolute pressure and residual oxygen in the degasified effluent. Instead of showing individual pressure exerted by each gas, the curves show only the relation of total pressure required in the deaerator as a function of the desired oxygen residual, with incoming water at various temperatures.

In Fig. 5, absolute pressures have been converted into vacuum measured from 30 in. of mercury, or one atmosphere at sea level. The three curves, Fig. 3, 4 and 5, are independent of water flow as long as the deaerator can perform its required functions.

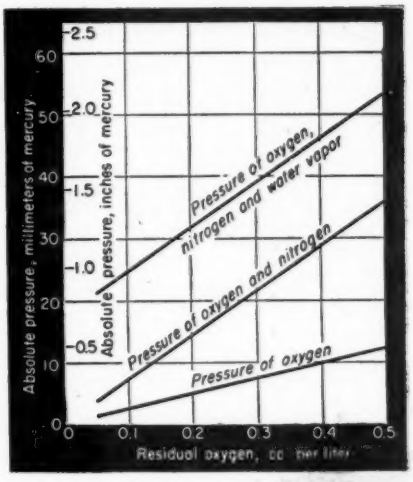


**Fig. 3—Absolute pressure required at 68 F for different oxygen residuals**

Data in Fig. 6 have been calculated for saturated conditions on the basis of 1000 gpm and show relationship between residual oxygen in the effluent and the volume of gas to be removed under vacuum conditions existing in the deaerator. Data are calculated for water entering the deaerator at various temperatures.

Regarding deaerator design, most cold-water vacuum units have been constructed from empirical data collected principally on degasifiers in operation. The same applies to the selection of vacuum pumps, which must be large enough to care adequately for air leakage that might develop in the equipment. This applies also to steam-jet ejectors or similar types of evacuators.

**Applicability.** Since many factors influence the mechanism of corrosion, generalization on the predicted effectiveness of deaeration may not be made safely without a comprehensive investigation of local conditions. Degasification of cold water as a corrosion preventive has limitations and is not a cure for all problems. The value is limited to correcting the corrosion-accelerating effect of certain dissolved gases, principally oxygen, carbon dioxide and hydrogen sulphide.

Other gases in the water may also contribute to the aggressive attack on ferrous and nonferrous metals. Fig. 7 shows the effectiveness of removing dissolved oxygen from water in contact with steel. Loss in weight of steel tubing in milligrams has been plotted for an aerated and deoxygenated water. In oxygen-free water, the rate is slow and retarded with time, whereas in an aerated supply, corrosion is accelerated continuously.

Data in Fig. 8 are theoretical calcu-

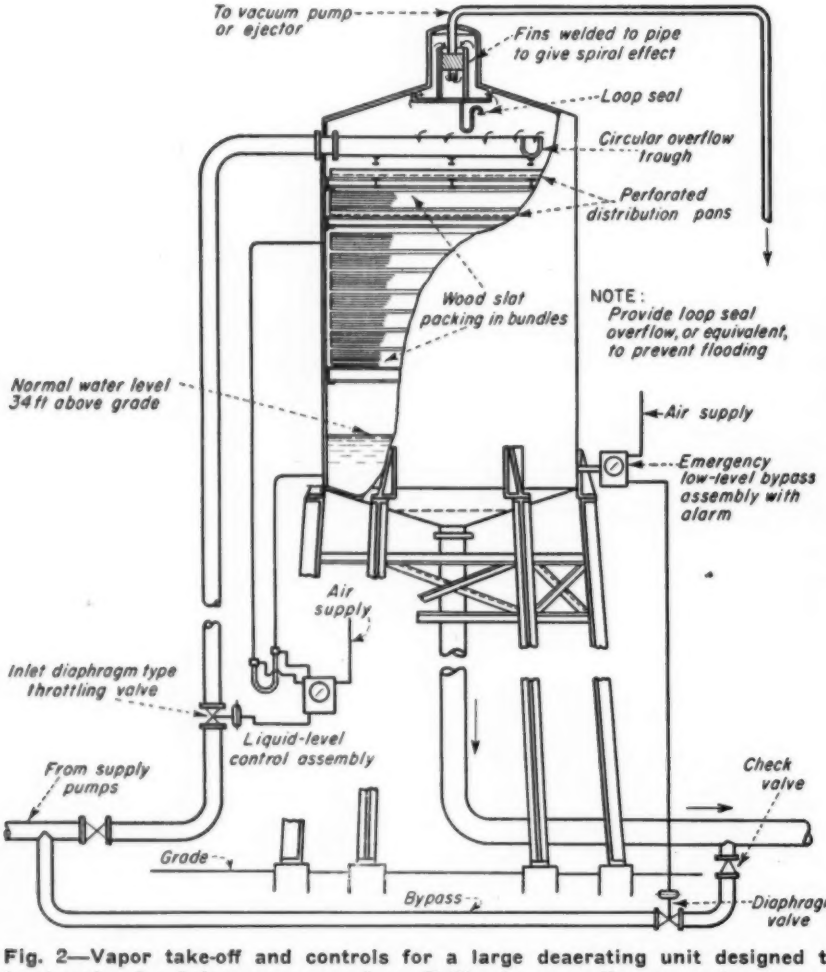


**Fig. 2—Vapor take-off and controls for a large deaerating unit designed to treat water for Arizona copper mine. Baffles in vapor line prevent carryover**

lations showing the weight of iron that potentially could be corroded annually from steel surfaces at various flow rates, assuming the water to contain various amounts of dissolved oxygen. Selecting a flow of 5000 gpm, several hundred tons of metal per year could be corroded if the water were saturated with oxygen. If deaeration limited the dissolved oxygen to 0.05 ppm, maximum possible corrosion would be about one ton a year. Many other factors affect the corrosion rate so the actual loss of metal would not be strictly comparable to the theoretical data.

The following examples illustrate practical results achieved through deaeration of cold-water supplies. Fig. 9 shows the effect of deaerating the water supply at Port Sulphur. As already stated, carrying capacity of this line decreased from 4 to 3.2 million gal a day in the first few months. After the pipe was cleaned mechanically and the deaerator placed in operation, line capacity was restored to 3.8 million gal a day. Total capacity decrease in the next eight months amounted to only 36,000 gal a day. Losses during intervening years have shown that corrosion, if it occurs, is moderate.

In 1938 a novel deaerator installation, 13,000 ft above sea level, introduced certain problems not encountered at or near sea level. Unit was to protect a 35-mile pipeline which, when new, delivered 3000 metric tons of water a day from a basin fed by mountain streams. Soon after installation, the line's carrying capacity showed a marked reduction from tuberculation. Within several years it was delivering less than 2000 metric tons a day despite modifications that were expected to increase its capacity to 4500 metric tons.

An 800-gpm vacuum deaerator, similar to the unit at Port Sulphur, was designed and installed. Water is lifted into it by the vacuum maintained. One vacuum pump was originally installed, which reduced the dissolved oxygen to about 0.60 ml per liter. Later, another pump was placed in operation. Residual-oxygen content of the effluent has since averaged about 0.45 ml per liter.

Samples of pipe, removed after several years, showed the inside surface reasonably free of corrosion. Capacity data, plotted from the time the pipeline was installed, indicate that after cleaning the pipe mechanically and placing the deaerator in service, line capacity was restored to 3000 metric tons a day. No further decrease in line capacity has occurred.

W H Atwill, in a recent publication, recorded the results obtained from a deaerating unit installed to reduce the corrosive properties of circulating water at the plant of the Texas Oil Co, Port Arthur, Texas. He reported 98% oxygen removal: residual oxygen content in the water was about 0.12 ppm.

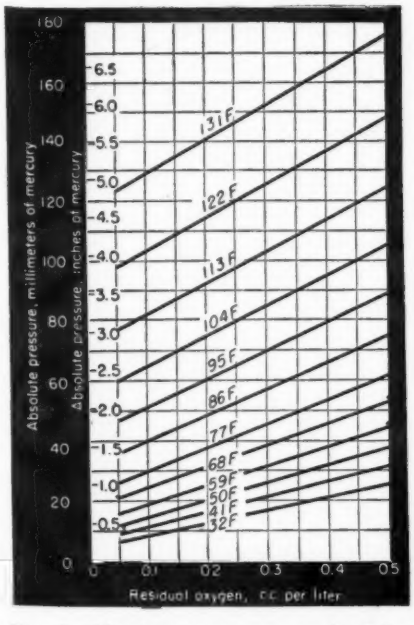


Fig. 4—Absolute pressure required for deaeration at various temperatures

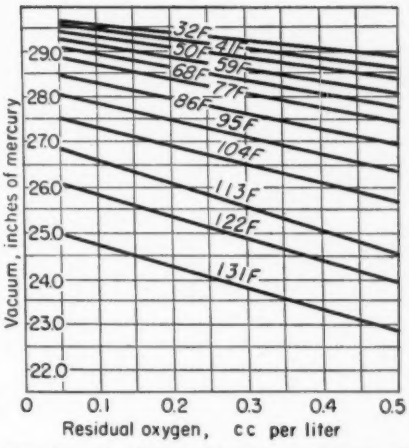


Fig. 5—Absolute pressure in terms of vacuum in relation to residual oxygen

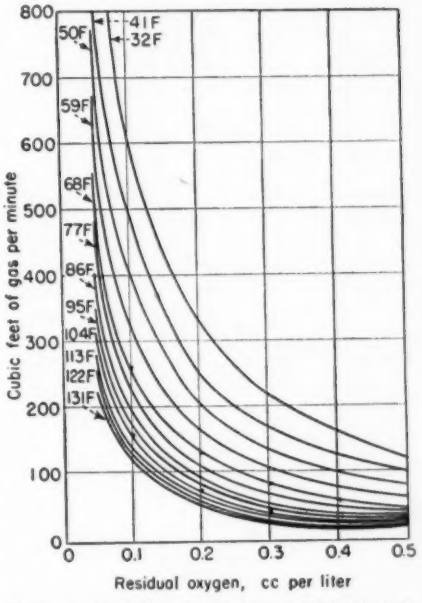


Fig. 6—Relation between residual and gas volume removed from 1000 gpm

## TUBE FAILURES

Before deaeration, six of nine water-cooled Admiralty condenser tube bundles failed in nine months, and two others within three more months. These tubes were replaced with red brass, copper nickel and arsenical Admiralty metal ones since experience indicated these were somewhat more resistant than Admiralty. After putting the deaerator in service no further failures occurred and steel tube bundles that normally failed in five months were in satisfactory condition after 26 months. Similar protection to various piping systems was also obtained.

For watercooled valves on gas-generating units where corrosion creates a critical operating problem, a 2500-gpm vacuum deaerator was installed to remove oxygen from zeolite-softened circulating water. Unit design is somewhat novel. A 2-stage steam ejector, equipped with an intercondenser, maintains desired vacuum. One ejector evacuates the gas directly from the deaerator, and discharges to the intercondenser from which the second ejector operates. Residual oxygen in the effluent is about 0.2 ml per liter, which meets the manufacturer's guarantee.

More than a dozen deaerators have been set up in one Government project. These operate in a closed-water cycle, whereas most installations operate on once-through service. Diameter of the units varies in size from two to ten feet. Before using the deaerators, sludge from corrosion deposited rapidly and clogged many small cooling lines.

Since the supply has been entirely degassed for over two years, no further difficulties have been experienced and active corrosion has ceased. Normally, the equipment has enough capacity to effect practically complete removal of oxygen and other noncondensable gas.

**Selection of System.** The decision to install a single- or multiple-stage deaerator should be governed to a large extent by economics. Original cost must be balanced against (1) daily operating cost (2) cost of using chemical deaeration to complete the treatment

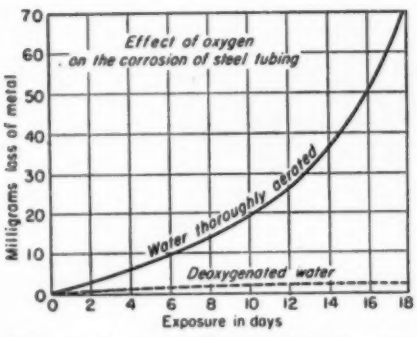
Effect of oxygen on the corrosion of steel tubing
Water thoroughly aerated
Deoxygenated water
Milligrams loss of metal
Exposure in days

Fig. 7—Loss of steel tubing in contact with aerated and deaerated water

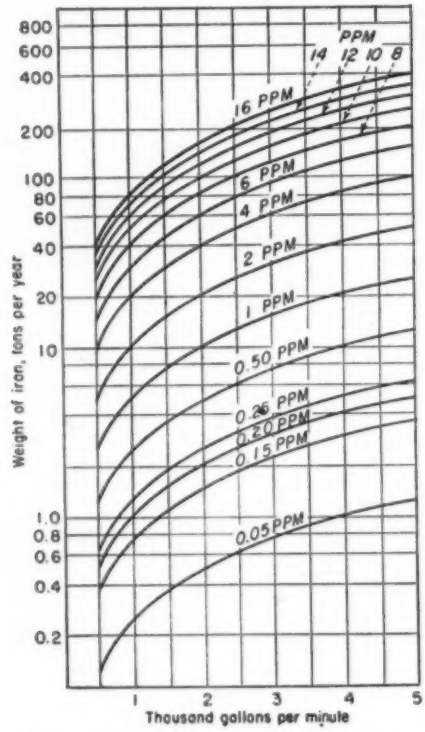


Fig. 8—Amount of iron that could be corroded away by oxygen in one year

and (3) reduction in losses that may be effected by selecting the most suitable design. Labor availability and nearness of a power source are other factors that affect design.

A multiple-stage vacuum deaerator offers a number of advantages: (1) Maintaining a difference in pressure between stages reduces the expanded volume of gas that must be removed by the vacuum pumps. It also effects a net saving in the original pump cost and daily operating charges. (2) Such a design permits removal of dissolved gas in smaller increments, the sum of which is appreciably less than if the gas were removed in one stage. (3) Practically, adoption of multiple-stage deaeration permits the economical maintenance of a lower amount of residual gas in the deaerated effluent.

In general, single-stage deaeration may prove the most economical for many installations. This can be determined, however, only after a thorough examination of the problem and local conditions.

**Secondary Treatment.** Since original investment cost and operating charges increased rapidly with increased vacuum, designers have sometimes limited the operation of deaerating units by controlling the vacuum within 25 to 28 in. of mercury. Still further reduction of residual oxygen can be effected by adding sodium sulphite or other deoxygenating reagents. Operators have resorted to such treatment in several instances in preference to installing and operating more costly units. The results have been successful in further reducing active corrosion from oxygen.

**Costs to Consider.** Investment and operating charges vary widely, depending upon completeness of design, local conditions, capacity of units, and other factors that influence structural requirements and power costs. In general, however, purchase cost of the complete deaerator, vacuum pumps or ejectors and necessary control accessories has been about $10,000 for a single-stage plant of 1000-gpm capacity. For each additional 1000-gpm capacity up to a total of 5000 gpm, purchase cost increases about $3500. Cost of extremely small installations, figured on the basis of 1000 gpm, has been two or three times that of larger units.

Multiple-stage units are, of course, more costly to install. Justification for such design depends upon the value of higher gas-removal efficiencies than can be effected by reasonable power consumption to produce a high vacuum by single-stage evacuation. If steam is readily available, steam-jet ejectors generally effect a saving in initial installation cost. Selection of evacuating equipment depends on the balance that can be arrived at in initial cost, daily operating cost, and the ease of operating ejectors as compared to vacuum pumps.

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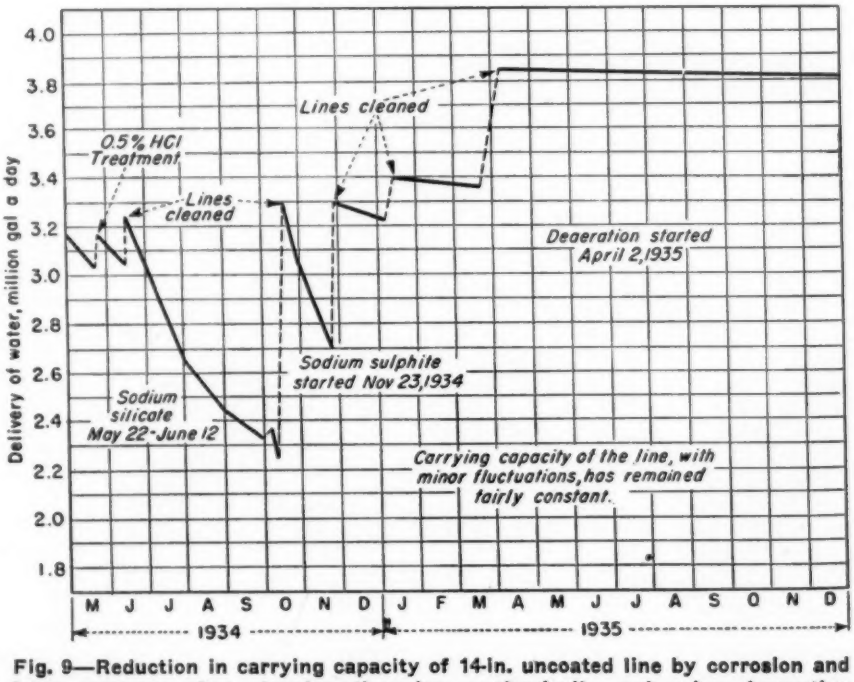

0.5% HCl Treatment
Lines cleaned
Lines cleaned
Deaeration started April 2,1935
Sodium sulphite started Nov 23,1934
Sodium silicate May 22-June 12
Carrying capacity of the line, with minor fluctuations, has remained fairly constant.
Delivery of water, million gal a day
M J J A S O N D J F M A M J J A S O N D
1934
1935

Fig. 9—Reduction in carrying capacity of 14-in. uncoated line by corrosion and later recovery after cleaning the pipe mechanically and using deaeration

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

# Cut Your Smoke by Increasing Turbulence

**You can work towards less smoke by stretching your available space for combustion. One quick way comes from added turbulence. Some Norwegian steamboats find this new smoke eliminator a means of promoting turbulence within firetube boilers**

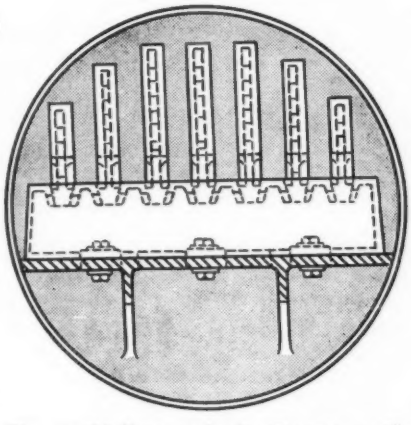


Fig. 1—Hollow rods in flue-gas path add air and help promote turbulence

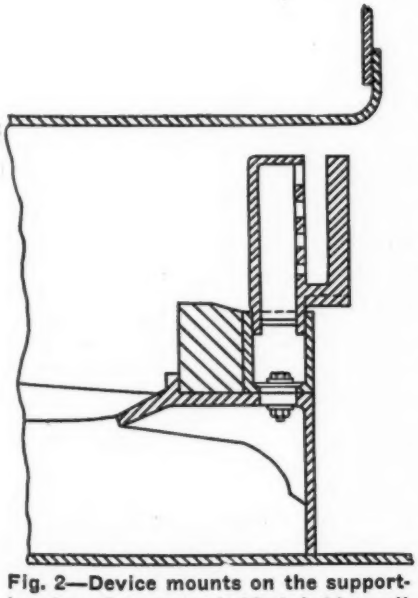


Fig. 2—Device mounts on the supporting bar for grate behind bridgewall

► PROPER, COMPLETE COMBUSTION requires time, temperature, turbulence. Without these essentials, smoke and other evidences of inefficiency show up. For example, steam generators, for boats, locomotives and some stationary designs, suffer from inadequate combustion space. Various aids, such as steam or air jets, develop an additional turbulence not built into the original design. This turbulence, in effect, extends combustion time and increases the richness of the combustion gas mix.

**Smoke Eliminator.** To promote this desired turbulence, a Norwegian, Leif Solberg, has patented a device that is entirely free of any moving parts. Its use so far has been on steamboats firing bituminous coal.

Briefly, the device consists of a series of hollow rods, or fingers, placed immediately behind the firebox. These rods, arranged in size to follow the physical pattern of the firebox, occupy about one fourth of its cross-section, Fig. 1, and extend all the way across the gas passage. For natural draft, a second set of solid rods, or fingers, is arranged behind the hollow rods. The second row acts as an impingement surface for auxiliary air leaving the hollow members. Air, striking the solid rods, is deflected into the path of departing flue gas to set up a turbulence.

The one general requirement is that the fingers must be able to withstand an oxidizing atmosphere of about 2000 F.

Test reports on operating installations show an increase in efficiency from the improved combustion, and absence of smoke in the stack discharge.

**Construction and Functions.** For the construction and functions of this smoke eliminator's elements, let's look at a firetube boiler of the 2-pass firebox class, Fig. 1, 2, 3.

Fig. 2 pictures the discharge end of a coal-fired furnace with a supporting beam for grate bars and bridgewall. It is on this supporting beam and behind the bridgewall that the smoke-eliminating device is mounted, as follows.

Holes are drilled in the supporting member. These holes line up with openings previously put in the rectangular, box-shaped base of the eliminator. When assembled, by bolting fast to the supporting beam, this box-shaped piece receives air from the space below the fire grates through the lined-up apertures in the supporting beam and box. The box, then, acts as a manifold for distributing preheated air.

On the upper edge of the long walls of the rectangular box, or manifold, are slotted openings regularly spaced, Fig. 1. These slots permit a detachable

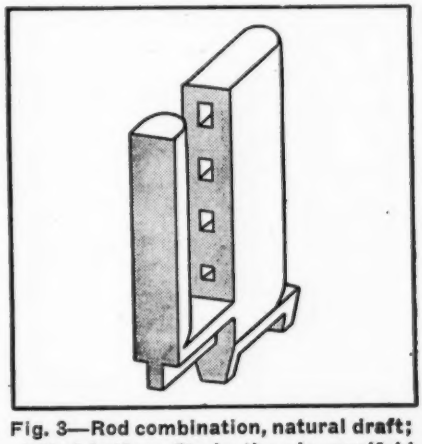


Fig. 3—Rod combination, natural draft; slotted bottom fits in the air manifold

fit for supporting the hollow, refractory or ceramic composition fingers.

The fingers, Fig. 3, are closed at their upper or top ends and open at their lower ends where they tie into the box, or manifold. That side of the fingers facing the exit flue gas has been streamlined to reduce its resistance to gas flow. (This may not be necessary.) The opposite face has several equally spaced openings of the same cross-sectional area through which air from the manifold mixes with the flue gas. With the firetube-type boiler these fingers vary in length to conform to the furnace shape, Fig. 1. The idea is to confine the normal gas flow.

**Natural-Draft Furnaces.** In natural-draft furnaces the second row of solid fingers, as mentioned, are set directly in the path of the air discharging from the first row of hollow fingers. This solid set, where applicable, should be made a part of the finger assembly, Fig. 2 and 3. Otherwise, a separate bracket running from the base of the solid finger must connect, for support, with its hollow counterpart or the manifold itself.

Flue gas, flowing through the throat sections formed by rows of fingers, comes directly into contact with preheated air, deflected into the gas path by the solid fingers. An intimate mixture of gas and air and a turbulence develops in this area.

**Combustion Aid.** An additional combustion help occurs because the fingers, in the path of hot combustion gas, build up a high temperature. The solid member has been heated to incandescence in some instances and acts as an ignition medium for the mixed air and unburned gas.

Fig. 4 and 5 show stationary firetube boilers whose furnace and gas-passage construction follow the general scheme described above. For each furnace, a separate brick setting has been employed. One is a typical horizontal-return tubular boiler, fired from the front end. Combustion gas under the influence of stack draft moves over the bridgewall into an area where combustible gas and air may mix. From this space, the gas passes through firetubes to the stack itself. Mounting the eliminator device, in the restricted area formed by the bridgewall and the boiler drum, may help induce greater turbulence and more intimate mixture of air and combustible gas at this point.

In Fig. 4, a typical wet-back Scotch marine unit indicates the relatively short distance between bridgewall and firetube entrance. Greater turbulence and better mixing, developed early in the flue-gas travel, help establish a more complete combustion and a freedom from usual smoking tendencies.

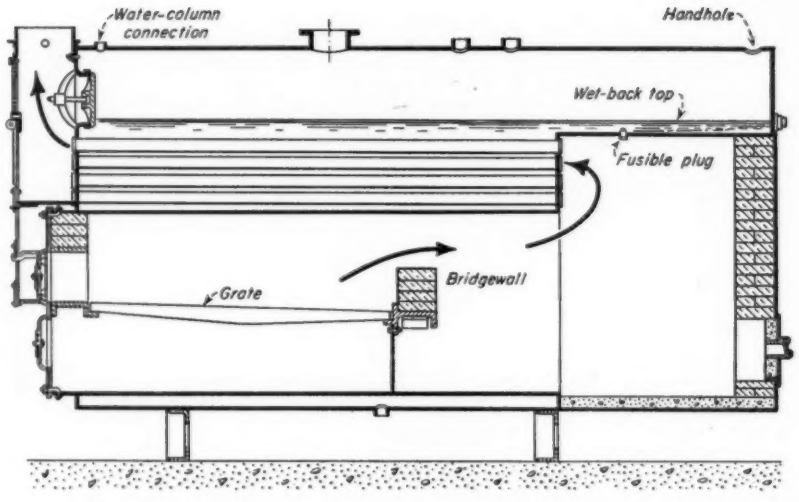



**Fig. 4—Typical wet-back Scotch marine unit follows design where furnace gas has short travel before entering firetubes; added turbulence cuts down smoke**

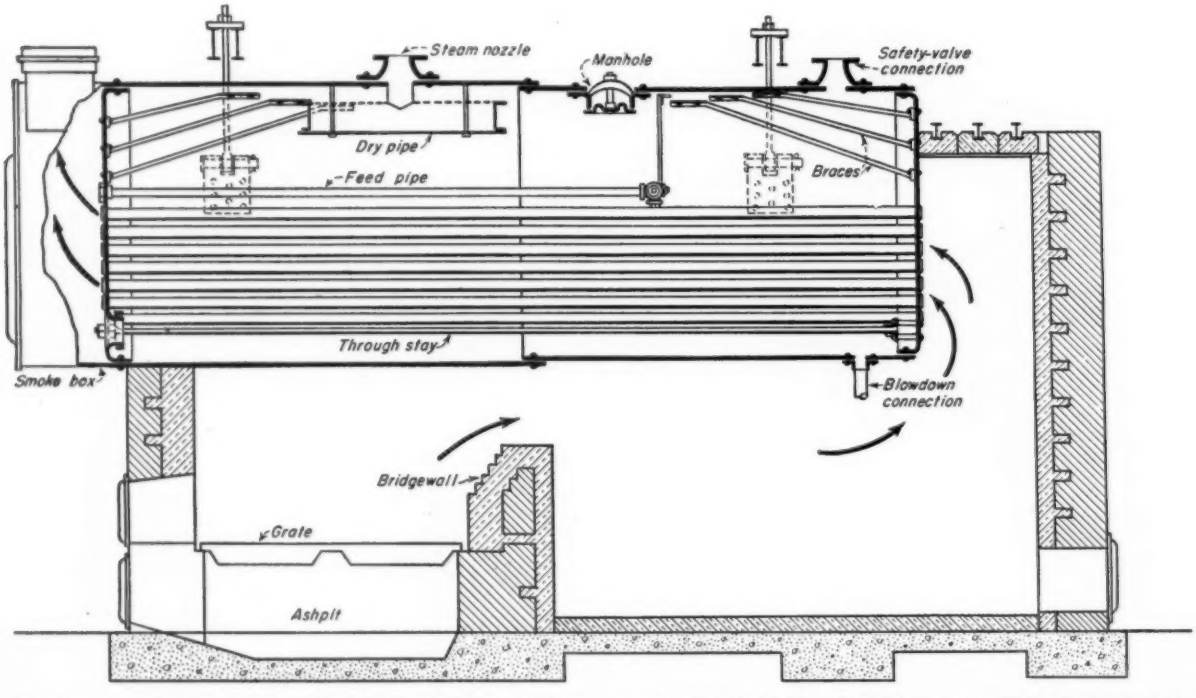



**Fig. 5—Front end-fired horizontal-return tubular boiler illustrates class of firetube design where eliminator device may prove helpful. Mounted in restricted space between bridgewall and boiler, it gives an added mixing action.**

# PHOTOCELL Improves Sander-Dust Burning in Veneer Plant

▶ WOODWORKING AND VENEER PLANTS try to meet a share of their fuel requirements with waste products. One source of waste, sander-dust, is a combustible that presents special problems. A simple photoelectric control, devised by J B McFall, U. S. Plywood Corp, Seattle, eliminates many of these problems so sander-dust is a satisfactory fuel.

**Here's the Method.** Dust from sanding machinery enters a cyclone where it is concentrated. From this collection point it goes to the boiler. At the Seattle plant of U. S. Plywood Corp, boiler equipment includes dutch ovens and the flat grates—a combination that permits burning hogged fuel.

A secondary furnace located behind the dutch oven serves as a combustion chamber in which burning is completed. Sander dust enters the combustion chamber through a device somewhat like a pulverized-coal burner.

An operating difficulty arose from a variation in the ratio of sander-dust concentration to air entering this burner. When plant load was light, amount of sander-dust fell off and the burner fed mostly cold air into the combustion chamber.

**Photoelectric Cell.** To solve this problem, McFall devised the arrangement below. A damper installed in the dust line leading to the secondary-furnace burner permits routing the air stream back to the cyclone if sander-dust concentration falls below an acceptable level.

A photoelectric cell measures dust concentration and provides the impetus for opening the damper valve and closing it when concentration falls off.

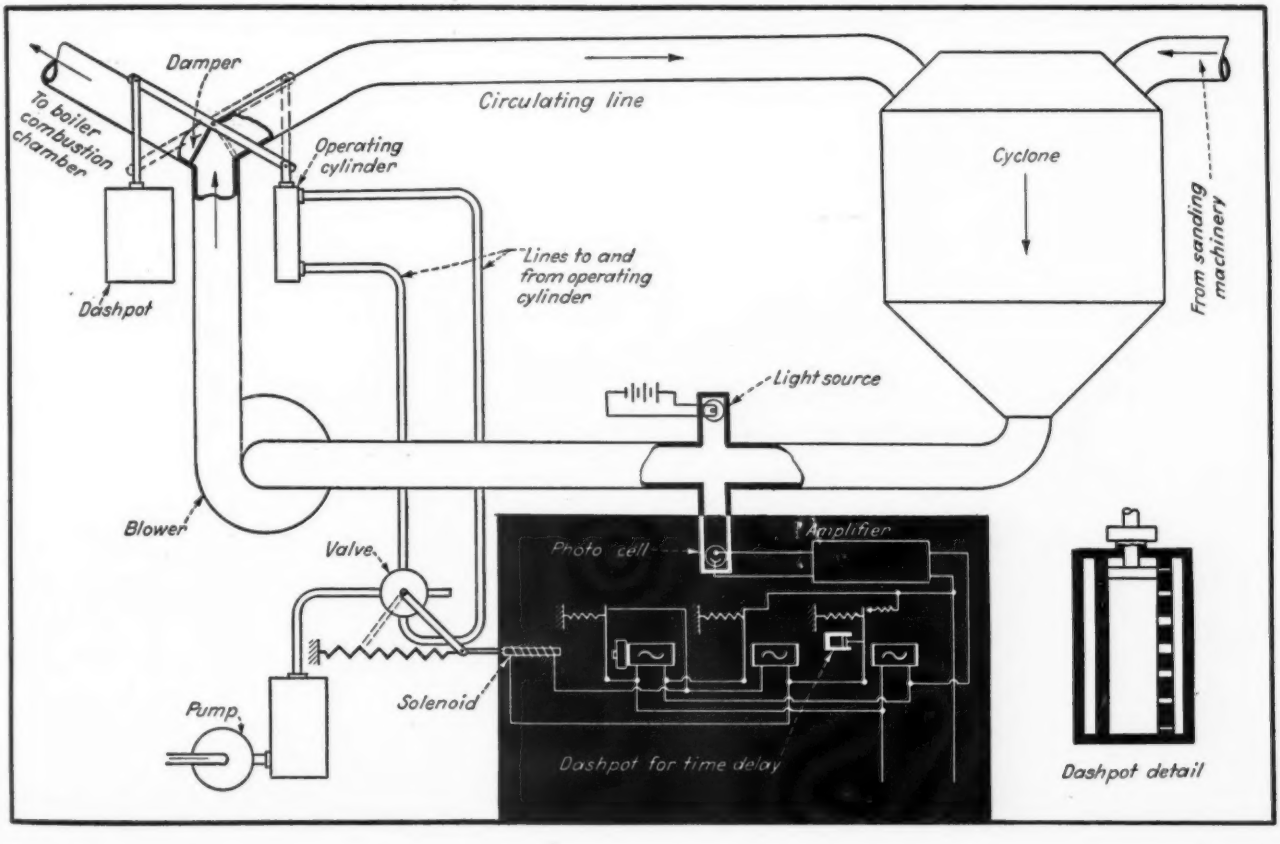
Current from the cell, passed through an amplifier, energizes relays. These relays operate a solenoid-controlled 4-way valve in a hydraulic system. It is this valve that directs the flow of hydraulic fluid into the operating cylinder to actually position the damper.

**Damper Operation.** Opening and closing of the damper follows this sequence. When dust concentration runs too low, the solenoid pulls the valve lever to the position shown in the sketch below. Pressure, then on the top of the piston in the operating cylinder, moves the damper to the position shown and air recirculates. When concentration reaches an acceptable level, the solenoid swings the valve lever to the opposite position and flow in the hydraulic system reverses, putting pressure under the piston to open the damper.

A dashpot, ported as shown in the diagram, connects to the damper lever. Variations in port size make for slow travel at the ends of the lever stroke, and faster travel in the middle.

Use of this patented control arrangement has made sander-dust burning relatively troublefree as auxiliary fuel.

**Damper installed in sander-dust supply line from cyclone shuts off fuel to the combustion chamber if photoelectric cell shows low concentration. The electric circuit (white on black) has time delay to prevent any hunting**



# PRACTICAL AIDS TO OPERATION

*Plant-Tested Methods and Ideas for Power Men*

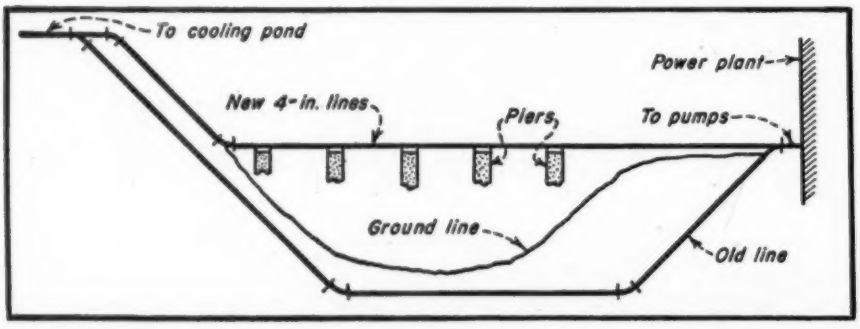
## REMOVES SEDIMENT POCKET FROM PIPELINE

RAW SPRAY WATER for our cooling system is hard and contains sediment, also dirt blown into the pond during dry, windy periods. The pond is across a valley from and a little higher than the power plant. In our initial installation the soft and raw-water lines to the pond were run under the valley, thereby forming a pocket, as in the diagram, where sediment accumulated.

Our soft water forms neither scale nor sludge so our immediate problem was to improve the raw-water lines. We poured a line of concrete piers and on these laid the raw-water lines, across the valley straight from the pumps, as in the photo. On the opposite side of the valley from the pumps the pipes bend to fit the hillside slope for a short distance and then tie into the old lines.

We graded the lines slightly and installed tees for draining them. Drains are between the 3rd and 4th piers from the near side of the valley. We put a 2x12-in. plank on top of each pier, on which to rest the 4-in. pipes. Top of the piers, 12x26 in. in cross-section, will be large enough for the soft-water lines if it becomes necessary to put them above ground in the future.

*Shiprock, N. M.* JAMES H MAHER




## Pressure Above or Below Disk of a Globe Valve?

WHEN INSTALLING a globe valve, it is customary to locate it in the line so pressure will be under the disk. Special cases, however, require an exception to this rule where globe valves must be installed with pressure over the disk.

Several nationally known manufacturers of globe valves mark them with a directional arrow to insure valve installation with pressure under the disk.

For boiler-feedwater piping, the *ASME Code*, p 317, states that: "There shall also be a globe valve on the branch to each boiler between check valve and supply source. Wherever globe valves are used on feed piping, the inlet shall be under the disk of the valve." The object of this provision is, of course, that if the valve stem breaks, the pressure will lift the disk and let water feed to the boiler.

An exception to this rule is installation in a vessel whose contents might be discharged if a valve stem were to break. Here it would be most practicable to install the globe valve with the pressure over the disk. With pressure in this position, however, liquid (especially if it contains chemicals) is in direct contact with the packing, and so requires more attention.

A national valve manufacturer has this to say: "In lines carrying liquids, particularly oil, provide some means to prevent the liquid being trapped in the valve bonnet, and thus eliminate possibility of pressure building up as a result of temperature rise." This provision means that on an open line

the valve should be installed for pressure under the disk.

For continuous blowoff lines, one popular model of flow-control valve is essentially a globe valve, which the manufacturer recommends installing with pressure over the disk to provide fine throttling.

For steam throttling some operating engineers prefer to have a globe valve installed with pressure over the disk. They argue that finer adjustment can be made with less wire drawing on low loads than with the valve installed so pressure is under the disk.

Pressure under the disk permits the valve to open more easily, especially a large one on high pressure, if it is on a shutoff line.

For water, steam or oil, at all pressures, installation of a globe valve is more satisfactory with pressure under the disk, except in certain cases. When using globe valves with renewable composition disks, some manufacturers request that whenever possible the valve be installed that way.

Engineers used to object to conventional old-style globe valves for continuous service because of the high-pressure drop across them. This objection has been overcome in some makes by streamlining the valve body and, as a result, globe valves are now used more extensively than before.

When installing a globe valve on a steam line, place it where possible in a horizontal run with the stem vertical. If a globe valve is placed in a vertical riser, it has a tendency to seat off center, and must be reground oftener than when the stem is vertical.

On the end of a line, pressure over the valve's disk is the recommended practice on hot liquids or steam so cooling of stem and disk will not cause leakage.

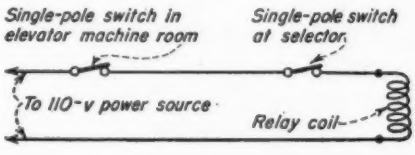
*Leonia, N. J.* WM PERRY KEARNEY

## WOOD BLOCK POSITIONS ELEVATOR SELECTOR

ON AN AUTOMATIC traction elevator the floor-selector position must be corrected when the car arrives at top and bottom landings to compensate for hoist-rope slip on the traction sheave. On the elevators in the McGraw-Hill Building this is done by limit nuts on the selector-carriage driving screws.

Our service elevator runs from basement to top floor, but during the day it runs chiefly express passenger service from street to top floor. For passenger service the car does not go to the basement to correct the selector's bottom position. We solved this problem with a wood block that just fits between the selector-brush carriage and the control-room floor when car is at street level.

During the day if the dispatcher wants to send the car to the basement he calls the mechanic in the elevator-machine room to remove the block until

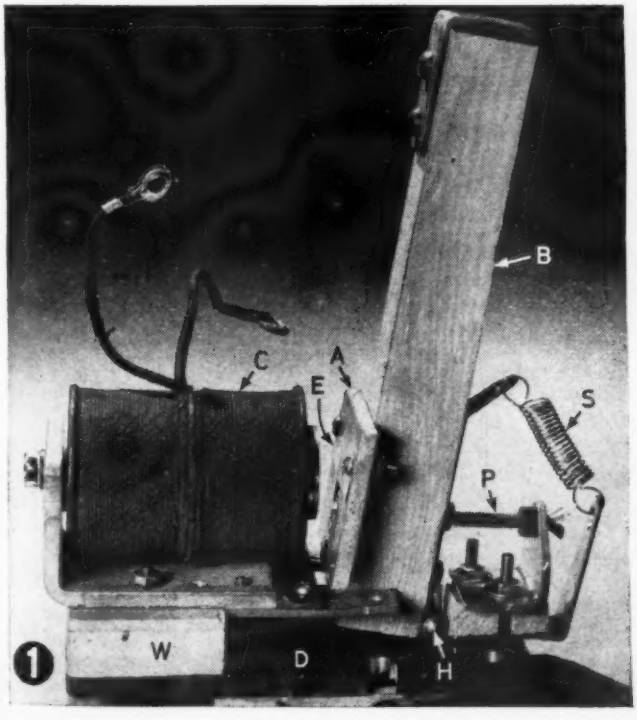


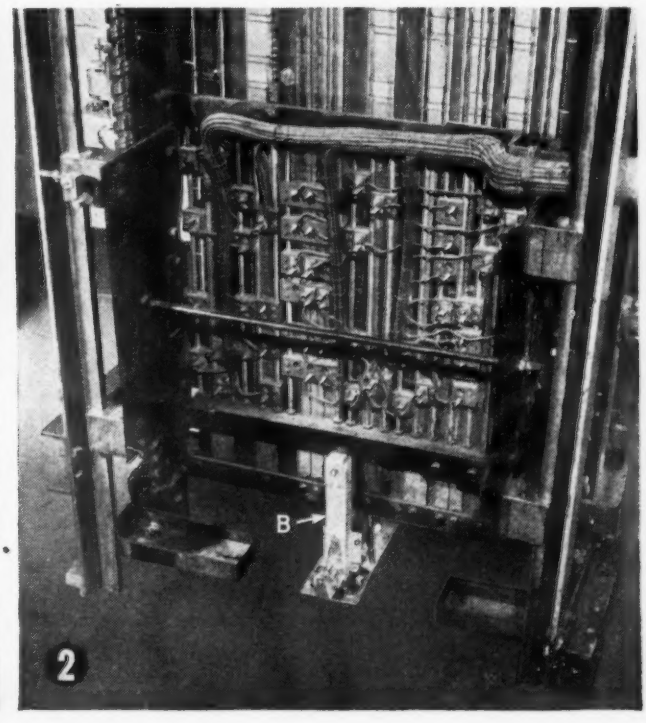

the car goes down to the basement and returns. Removing and replacing the block proved quite a chore because the mechanic had to climb down two floors below the motor room and climb back again. We decided, therefore, to find an easier way of doing the job and built a relay operated block, Fig. 1.

Block *B* is hinged at *H* and held in the out position against stop *P* by spring *S*. The part to which block and spring are attached is made from a flat door hinge. Magnet coil *C* is a spare from one of the elevator control relays. This coil with its magnetic core and mounting is isolated from steel-plate base *D* by a wood block *W*.

A steel armature *A* on the block completes the magnetic circuit for pulling the block in position under the selector's carriage. We attached a thin copper strip *E* across the armature's face to insure quick release of the block when the coil is deenergized.

Coil and block *B* are mounted directly



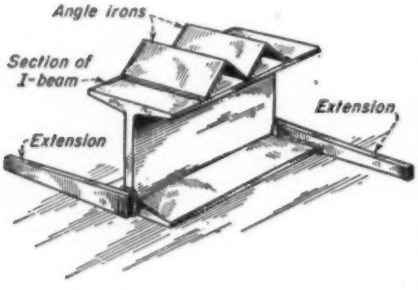
under the selector-brush carriage, as in Fig. 2. Coil connects to the 110-v power supply through two single-pole single-throw switches, (see diagram). One switch is placed in the motor room and the other near the selector.

These switches give complete control of the block's position from either location. Now when the dispatcher calls the motor room for the mechanic to change the block's position, he has only to close or open one of the single-pole switches.

FRANK SCHLIEFF
*New York, N. Y.*

## Extensions Stabilize Pipe-Welding V-Blocks

THE V-BLOCK STEADY REST, in the diagram, for supporting pipe during welding is made from a piece of 6-in. I-beam. Two pieces of 2½-in. angle-iron are welded across one of its faces, to form




a V for holding the pipe. These blocks are also convenient for supporting the shaft of any rotating part, such as the rotor of a motor or generator.

When welding pipe, the V-blocks may overturn if the pipe is pushed endwise through them. This can be prevented by welding extensions to each end of the lower face of the I-beam, as shown. These extensions are cut from pieces of scrap-steel plate and extend from opposite sides of the base. They prevent the V-blocks tipping in either direction without adding materially to their weight. The extensions also serve as convenient handles for lifting or positioning the blocks.

*Portland, Ore.* B R RUSSELL
*The Linde Air Products Co*

## Brushes Off Neutral Blacken Commutator, Rings

WE HAVE a 200-kw rotary converter that operates about 50% loaded. Even though it did not give serious trouble its performance was not satisfactory. Burned spots developed on the slip-rings, every fourth bar in the commutator blackened, and the pilot brushes sparked when the machine started.

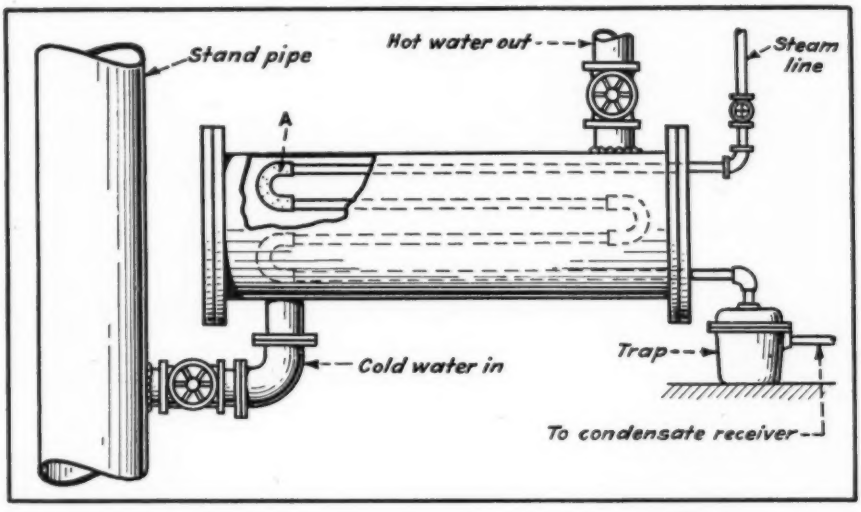
We worried along with the machine for several years, then had the armature removed to a repair shop. Here the sliprings and commutator were turned and polished to a true surface; the winding was baked and given two coats of insulation varnish.

We thought that vibration might have contributed to the machine's poor performance. So while the armature was in the shop we had it carefully balanced. Because the old foundation was not as rigid as it should have been we built a new concrete one.

When the machine was reassembled and new brushes installed, it did not perform any better than before it was overhauled. The manufacturer's engineers were then called in; after checking the commoner causes of slipring and commutator trouble, they checked brush position on the commutator. This test showed that the brushes were set two bars back of the neutral.

The brushes had been positioned in the manufacturer's shop and the brush yoke doweled in place, but evidently some one made a mistake when the brush position was determined originally. This experience shows that when the cause of trouble is difficult to locate nothing should be accepted as correct without careful test. Changing the position of the brushes on our machine greatly improved its operation.

*Boston, Mass.* B R STEWART



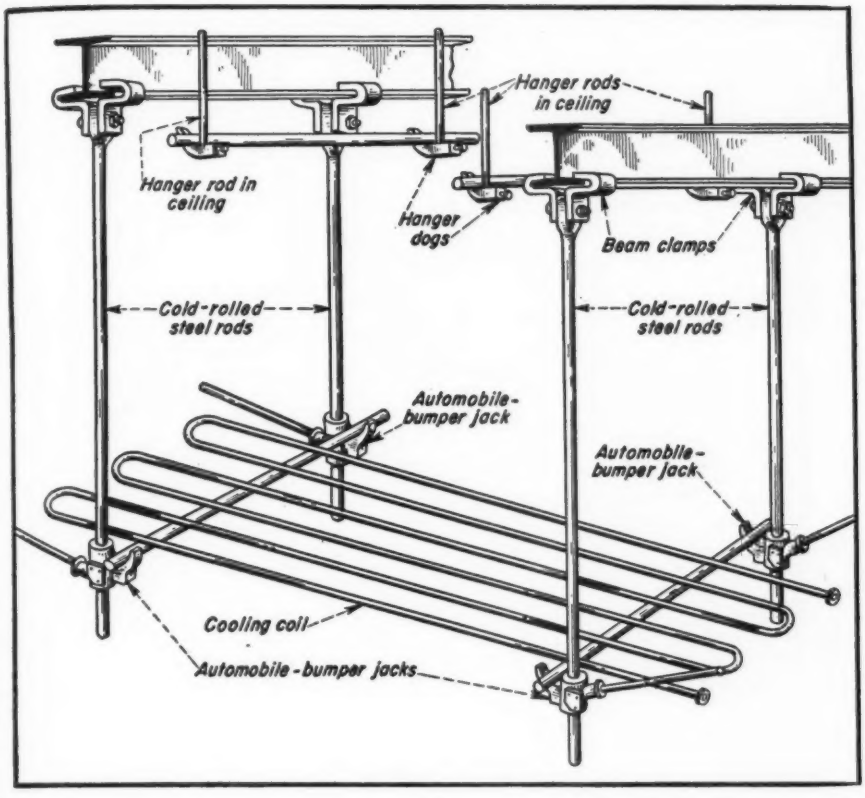

## DEFECTIVE FITTING CAUSES OVERFLOW

A 55,000-GAL WATER TANK installed on a sprinkler system operated all winter but lost water the next spring. This tank was equipped with a steam heater to prevent water from freezing in it during the winter. Operation was satisfactory in cold weather, except that there was a small flow of water from the tank's overflow to the sewer. As this discharge was small, nothing was done to trace the cause.

When heating steam was shut off in the spring the sprinkler tank began to lose 4 to 6 in. of water per day. The contractor and firewriters' inspectors were called in to find the cause, but despite 125-psi pressure maintained on the system for 24 hr no leaks were found. About this time the engineer noticed that the condensate receiver in the boiler room was discharging water through its overflow when the makeup-water valve was tightly closed. Several condensate pipes entered the receiver. By tracing them the engineer found that the water was coming from the sprinkler tank heater shown in the diagram.

When the heater was opened a heating coil return bend, as at *A*, was found full of small holes. This explained the trouble. In winter when steam was on the heater, some of it discharged into the recirculated water and accounted for the small overflow from the tank to the sewer. When steam was shut off from the heater, water from the tank entered the heater coil through the defective fitting, and flowed through the trap back to the condensate receiver. Replacing the defective fitting corrected the trouble.

*Montreal, Que.* C R ROBINSON




## AUTO JACKS RAISE HEAVY COOLING COILS

How to lift long, heavy sections of pipe coils with anything less than a big gang of men is a problem that can be solved by the use of automobile jacks of the bumper type, which "climb up" a smooth rod, as in the diagram. The coils were 30 ft long, and 16 pipes wide. Being made of 2-in. full-weight pipe, each weighs more than 1750 lb. There were 16 sets of overhead coils, which were flanged to shorter pieces to make a total length of 49 ft, 7 in., to be installed under the ceiling, and along the walls of a large zero-degree room in a frozen-food locker storage.

Cork-board insulation left the steel posts and roof beams exposed inside the room. Standard I-beam clamps were attached to the steel framework, from which were suspended rods of cold-rolled steel. They were bent at the upper end to form an eye, the looped ends being welded for safety. Where the steel beams were not available, the rod eye was looped over one of the hanger dogs and wired in position for safety.

After the vertical rods were in place the jacks were run up a distance from the floor, and the bearer pipes were placed across them. These pipes supported the coils while the automobile jacks were pumped until the coils were high enough to be supported by the dogs on the regular hanger rods, which extend down from the concrete ceiling. After all the coils in one bank were in position, the lifting equipment was moved to the next aisle. Longer and heavier coils could be raised in the same manner by using more jacks, preferably closer together.

*Waynesboro, Pa.* Frank H West
*Frick Company*

## Alarm Bell Saves Steam-Engine Bearings

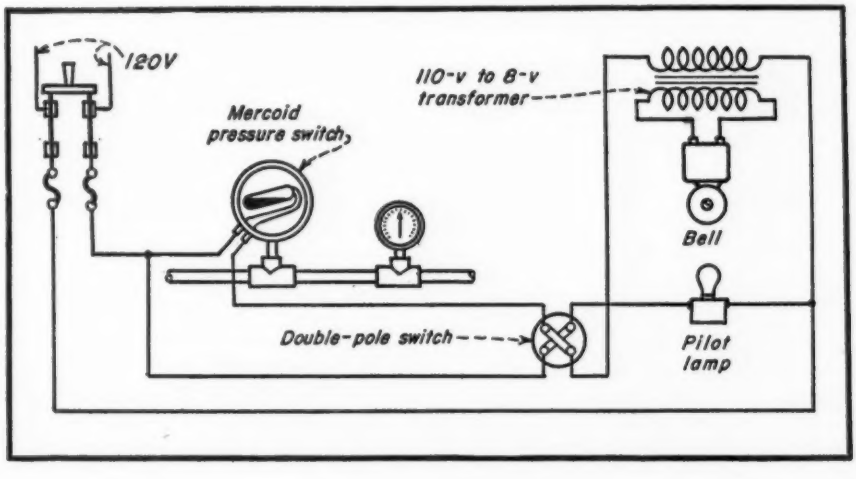
On our vertical Unaflow engine all important bearings are oil lubricated at 18 to 20 psi. If the oil supply fails and the engine is not immediately shut down some of the bearings are burned out. When I heard that this happened in another plant I decided we should prevent such a casualty befalling our engine.

In the oil-supply line near the pressure gage we installed a T to connect a mercoid pressure switch as in the diagram. Tilting this switch opens or closes its contacts. We wired it into the 120-v lighting circuit and a bell-ringing transformer connected to a 4-in. bell. We set this switch to close its contacts and ring the bell if oil pressure drops. Our engine and boiler room are separated so we put the bell in the boiler room where the one engineer working on the night shift spends a large part of his time.

We installed a switch in the circuit so the bell could be switched off when the engine was stopped for cleaning and adjustment. Sometimes the engineer forgot to turn on the switch after starting the engine, so we installed a pilot lamp, which lights when the switch is closed. Placed where the engineer will pass it when going from engine to boiler room, this lamp reminds him that if the light is out the alarm is not switched on. A double-pole switch is used with one pole in the bell and the other in the light circuit as shown in the diagram below.

This alarm has twice saved the engine's bearings: (1) The oil-pump shaft broke and (2) by mistake, the engineer connected the oil centrifuge's spouts to discharge the oil to the sewer instead of to the filter tank. Installing the alarm cost only about $40, but it has saved several hundred dollars in bearings that would have had to be replaced, besides the cost of having the engine out of service.

*Boston, Mass.* C R Kinney



# READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

## 1—Why Do Solenoid Valves Stick Shut?

IN OUR ICE and cold-storage plant, solenoid valves in one of the departments do not work satisfactorily. In the frozen-food section, where the trouble occurs, there are three compressors. One is for the locker room and deep-freeze cabinet. The second is for the cutting room, and the third for the chilling and aging room. It is the valves in the chilling-room system that are giving trouble. They stick shut and will not open.

Refrigerant is Freon-12, and the solenoid valves are located in the liquid lines. The room temperature is 32-35 F. The backpressure is 20 psi and the head pressure is 115-120 psi. Each valve is rated 16 watts at 115 v. I have checked the refrigerant—there is no shortage. The voltage at valve terminals is 112 v. New valves that worked satisfactorily in other locations are no better. The thermostats and expansion valves have been checked and are in good condition.

As long as the machine is running the valves work fairly well. But when the compressor stops and the thermostat calls for it to start again, the valves will not reopen. There is only a loud chattering noise. If we open and close the circuit to each valve several times it will sometimes open with a hissing, humming noise. Can POWER readers suggest what is wrong with these valves or why they don't work here as they should?—*HF*

## 2—Should I Add Compound To Individual Boilers?

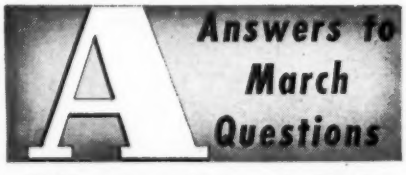
OUR BOILER ROOM contains six boilers in two banks of three each. There is one water softener that feeds makeup water to the six boilers. I have noticed that every time we cut a boiler in or out the concentration of alkalinity or hardness becomes affected.

I thought maybe we could add a container to the feed line for each boiler so that additional compound could be added whenever necessary under the changing conditions described.

Would this container act as an air chamber in the feedwater line, and thus cause damage to the system? If POWER readers have used a similar scheme, I would like to see a sketch of it. The diagram on this page, June Q-1, shows the arrangement I have in mind trying. Do you think it will work?—*HB*

*Editor's Note*: Revised printing schedules make it necessary to allow two months between publication of questions and contributed answers.

Ordinarily you would find here answers to the two questions that appeared in April, but instead they will be published in July. The two questions in May will be answered in August POWER. To insure publication, answers should be mailed before end of the month of the issue. Thus, your answer to a question in June POWER should be mailed before the end of June.




*WJH's* valve problem in the March issue brought so many letters from readers that only part of them appeared in May. The remainder are given below.

## Are Blowdown Valves In the Right Spot?

*(This is Question 1 from the March issue, with best answers from readers)*

*We have a blowdown valve-and-pipe arrangement that should be corrected. Before laying out changes in our boiler room, which is over 40 years old, I want to be sure they are justified. The room, which has two 750-sq-ft hrt boilers, is 16 ft below ground level. It is a hot hole, and cramped for space. The layout for the piping is shown in sketch Q-1* (*March* POWER).

*Some of the men use one sequence, and others use a different one for blowing the boiler. The only idea common to all is to do the job and get out of the hot cramped space behind the boilers as fast as possible. One method is to open the two blowdown valves first, and then open the quick-opening valves one after another. They guess at the amount of blowdown, then kick the quick-opening valves shut and close the blowdown valves.*

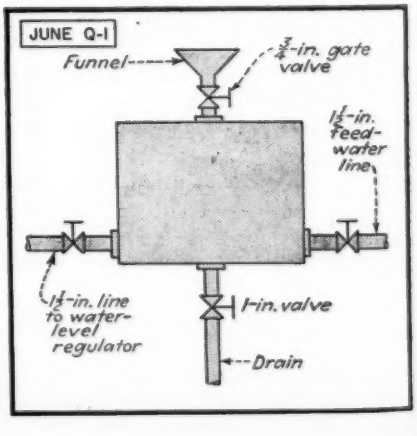
*It seems to me that each boiler should have two valves in the connecting line ahead of the blowdown line. Shouldn't valve D on No. 2 boiler be somewhere in the line running from the boiler instead of in the location shown? Assuming the hookup indicated is maintained, what is correct sequence of valve opening, starting with No. 2 boiler? If* POWER *readers can suggest better arrangements or good ways to handle our present system, we would like to try them.—WJH*

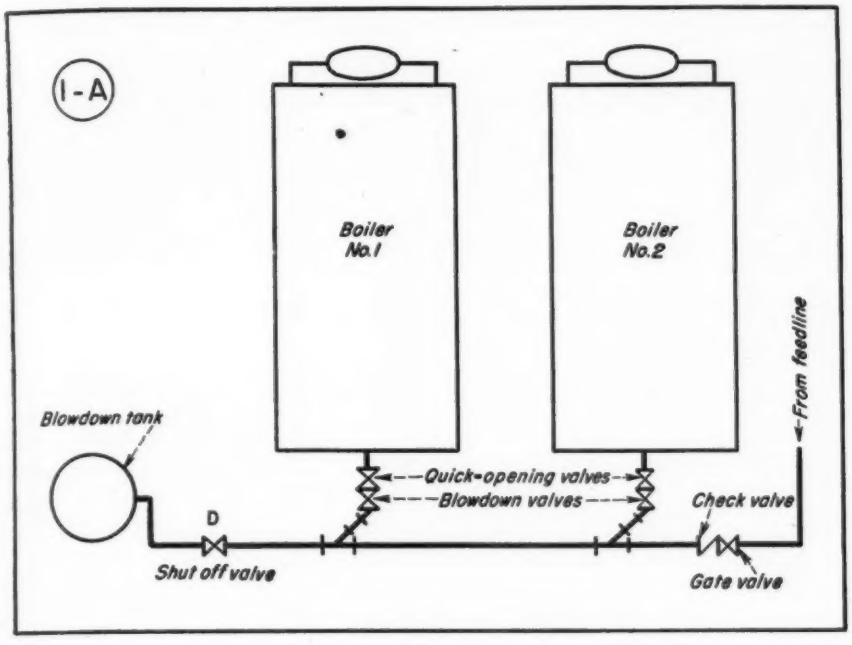
## Place the Two Valves End to End

ON BOTH BOILERS *WJH* should have the blowdown valves installed adjacent to the quick-opening valves in the branch lines and not in the header. Old practice is to have an additional valve at *D*. It is normally open but can be closed to permit leveling water in the two boilers by opening both blowdown valves, in the event of feed-check trouble on one boiler. A connection can also be made to the blowoff line from the feed line to permit feeding either boiler through the tail line in emergency, as on sketch 1-*A*.

Normal procedure for blowdown on layout in sketch is (1) Open one quick-opening valve, (2) Open corresponding blowoff valve, (3) Close this blowoff valve, (4) Close quick-opening valve, (5) Repeat on other boiler.

With the present arrangement the best method, starting with all valves closed, is: (1) Open valve *D*. (2) Open quick-opening valve A. (3) Open valve *B*. (4) Close valve *B*. (5) Close valve *A*. (6) Close valve *D*. (7) Open valve *C*. (8) Open valve *D*. (9) Close valves *D* and *C*.






A quick-opening valve should be used only for open-and-shut service, never for blowing down. That is, do not open or close it with blowdown water flowing through it.

*Rock Hill, S. C.* J C PORTER

## Rearrange Valves

IF WJH HAS GOOD VALVES on his boilers he need not purchase new ones. He should by all means rearrange them, so each boiler is independent and has no valves in the main trunk line. Valves and line should be above blowdown tank if possible so the line will not stand full of water.

To have a dry line it may be necessary to bring blowdown lines out horizontally from boiler bottom and have them enter top of tank.

*Spokane, Wash.* E D DEMHURST

## Valves Can Be Used

WJH'S BLOWDOWN VALVE and piping arrangement is odd and somewhat objectionable. To blow down No. 1 boiler, valves *D*, *B*, and *A* must be operated. Also, when No. 2 boiler is opened for cleaning and inspection, it is protected only by valve *C*. These objections may be overcome by placing one quick-opening valve and one blowdown valve in the connecting line ahead of the blowdown line. In operation, the quick-opening valve is opened wide first, then the blowdown valve is opened slowly to wide-open position. When the required amount of blowdown is obtained, close blowdown valve slowly until tight, then close the quick-opening valve gently. Always follow the same sequence.

If the hookup indicated is maintained, proper operating sequence, starting with No. 2 boiler, is to open valve *C* wide, then valve *D* slowly to wide-open position until the desired blowdown is obtained; close valve *D* slowly, then valve *C*. With No. 1 boiler, probably the best procedure is to start with valve *A*, opening it wide, then open *D* wide and use *B* for blowing down, opening it slowly to a wide-open position until enough water has been blown out; then close it slowly. With this method, valve *B* will stand a share of the blowing down wear; since *D* could be used to blow down both boilers, it would be better to divide the wear.

*Emporia, Kansas* H T CANTRELL

## Present Piping Is Okay

EACH BOILER of *WJH's* system should have two valves in the connecting line ahead of the blowdown line.

To prevent excessive wear to the quick-opening valves and shock to the blowdown piping, manufacturers recommend that quick-opening valves be opened first and closed last. With the present piping arrangement this would be awkward.

If the piping is not changed the proper way to blow down, starting with No. 2 boiler would be: Open valve *C* and then *D*. After the desired amount of blowdown, close valve *D*, then valve *C*. For No. 1 boiler, open valve *A* then *B*, and control blowdown with *D*. After the desired amount of blowdown close valve *D*, then *B*, and then finally *A*.

To prevent someone getting scalded and make it easier for workmen to blow down boilers *WJH* should (1) install combination blowoff valves (2) renew the old piping and (3) instruct the men in proper valve manipulation.

*St. Louis, Mo.* E E SCHELLENBERG

## Control Flow With Slow-Opening Valves

WJH SHOULD HOOK UP his two boilers as in sketch 1-*B*. Advantage of this rearrangement is that a man working in one boiler is protected when the other boiler is being blown down. Sequence to follow in blowing down is to open valves *B* and *D* before cracking *A* and *C*. This protects the seating surfaces of the valves and insures the tightness of the seats.

To avoid inadequate blowdowns, and to make it unnecessary for men to work under the conditions described, it is desirable to operate all four valves from a remote station by means of extension stems and, if necessary, by more elaborate mechanisms.

*Cliffside Park, N. J.* A DI LORENZO

## Put Both Valves Together

IN OUR PLANT the quick-opening valve is nearest the boiler, and the slow-opening valve is next to it as in sketch 1-*C*.

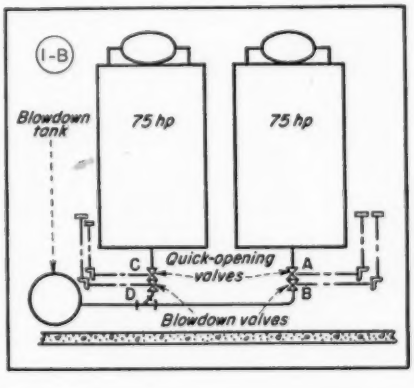
From arguments on the proper method of blowing down a boiler, the one generally agreed upon is that the quick-opening valve is opened first and closed last.

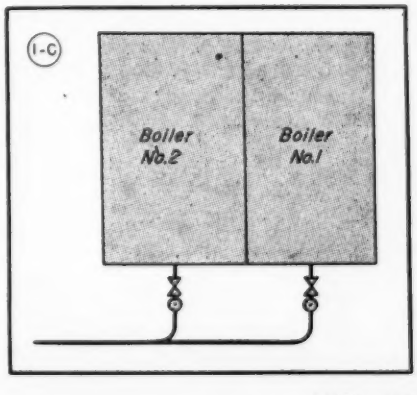
*Philadelphia, Pa.* T F CUNNINGHAM

## Move Valves Into Open

PRIMARY PURPOSE of using blowdown valves is to prevent premature seat failure in the quick-opening valve. The main idea is that the seats and disks of blowdown valves are readily repaired or renewed without shutting down the boiler as, for instance, when the quick-opening valve leaks.

Proper procedure is to open the quick-opening valve first and close it last. We have five hrt boilers that are equipped with quick-opening valves only, but as



these boilers are not all in service at one time it is easy to replace a defective valve. We machine and grind them ourselves and get satisfactory results.

Blowdown valve *D* in WJH's sketch should be immediately after valve *C* and in the same line as valve *C*, not in the common header pipe.

The narrow passage behind the boilers is both unsafe and too hot for a fireman to want to linger long. This may result in insufficient blowdown. Rearrange piping as shown in sketch 1-*D* so that valves *D* and *B* are away from the back of boilers and out where it is comparatively cool.

*Hamilton, Ont.* J A GOULDEN

## Piping Layout Is Incorrect

APPARENTLY the present blowdown valve and pipe arrangement should be corrected, and *WJH* merely wants confirmation. With the setup in his sketch, No. 2 boiler is fitted with only one blowdown valve. Valve *D*, which is acting as a master valve on the blowdown header, should be located directly behind valve *C* in the blowdown line from No. 2 boiler.

If sufficient space can be obtained by moving valves *A* and *C* closer to the boiler setting, I suggest installing valve *D* directly behind valve *C*, and valve *B* directly behind valve *A*.

Regarding the operation of these blowdown valves, it is good practice to impress on operators these two rules: (1) Open valves under pressure slowly. (2) Always protect the valve nearest the boiler by opening it first and closing it last. Rule (1) protects the operator since quickly opening or closing a valve under pressure may rupture some part of the piping. This would probably scald the operator in the cramped space described. Rule (2) will insure a tight-sealing valve nearest the boiler, making it possible to repair the outside valve, which is subject to greatest wear.

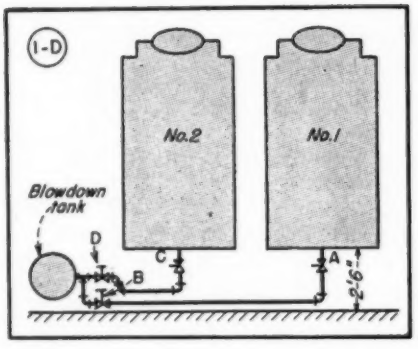
Should the present hookup be maintained the rules given above should be followed when blowing down. Sequence of valve operation will be: In blowing down No. 2 boiler: (1) open valve *C* (2) open valve *D* (3) close valve *D* (4) close valve *C*. For boiler No. 1: (1) open valve *D* (2) open valve *A* (3) open valve *B* (4) close valve *B* (5) close valve *A* (6) close valve *D*.

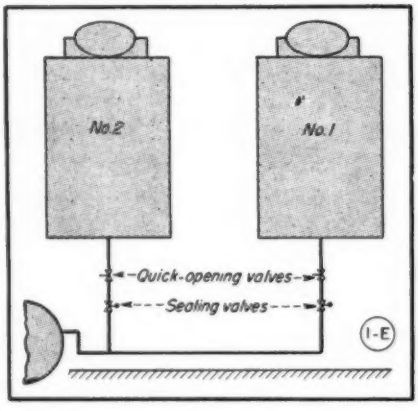
Note that, in blowing No. 1 boiler, the present arrangement makes necessary two more operations than are needed for blowing No. 2 boiler.

*Philadelphia, Pa.* W J WITHERS

## Use Tandem Valves

WJH IS CORRECT in believing his valve arrangement should be changed so that each boiler will have two valves in the connecting line ahead of the blowdown pipe, as shown in sketch 1-*E*. If he buys new valves I recommend tandem units.




Correct sequence of valve opening with the present arrangement is: Open valve *D*; blow down No. 2 boiler by opening valve *C*. Close *C*. Open *B*; blow down No. 1 boiler by opening *A*. Close *A*. Close *B*, then close *D*.

*Ninety-Six, S. C.* E W MCKNIGHT

## Put Blowdown Valves In the Same Line

THE ASME CODE RECOMMENDS the use of two blowoff valves for each boiler operating above 100 psi. This method is adopted in all well-designed plants. Both valves should be close together and, if flanged valves are used, they should be installed, flange against flange, without any intervening piping.

Main purpose of having two valves is to save the valve next to the boiler by using the other to take the wire drawing during the opening and closing. With two valves, wire drawing is eliminated on the valve next to the boiler by opening it first. For the same reason, at the end of blowdown, the valve next to the boiler is shut last. This concentrates wear and tear on the second valve; when it needs repairing there is no need to shut down the boiler.

In some boiler plants, only one individual blowdown valve is used per boiler; a second common valve for a battery of boilers is connected to the same blowdown header. The common valve is placed between the last boiler and the header. Under this arrangement, the procedure of blowing is to open the individual valve first and then the common valve. After the blowing, the common valve is closed first and then the individual valve. In this way the individual boiler valve is protected against wear the same as though there were two valves for each boiler. Valve arrangement in *WJH's* sketch does not agree with practice in well-designed plants. Since valve *D* is installed on the common line to both boilers, valve *B* becomes superfluous.

If the piping layout is to be revamped, I suggest that valve *D* be placed next to valve *C*, and valve *B* next to valve *A*. But if no change of piping is made, valve *B* can either be left wide open at all times or removed.

The present system requires a lot of walking back and forth from valve *D* to valves *C* and *A*; it is for this reason that in a well-designed plant you always find that each boiler has two blowoff valves installed together.

*Boston, Mass.* N T PEF

## Cool Behind Boilers

BY PUTTING IN another valve between quick-opening valve *C* and the blowdown line, *WJH's* system would meet safety requirements. With the present arrangement if anything should happen so valve *C* did not close, it would be impossible to blow down No. 1 boiler.

Amount of blowdown should be governed by testing the boiler water and following recommendation of manufacturer of compound used.

If possible, draw air for combustion from behind the boilers to make the boiler room more comfortable.

*Lombard, Ill.* H D BROWN

## Don't Slam Valve Shut

IT IS MY EARNEST SUGGESTION, as a safety precaution, to pipe the blowdown from each boiler separately to the blowdown tank. This tank should be vented to atmosphere with a 10-in. pipe and have proper drainage to dispose of the water.

The quick-opening valves should be installed next to boilers and used to close the line tight. The regular blowoff valves should be installed between the quick-opening valves and the blowdown tank. They should be the slow-opening and -closing type designed for easy repairs.

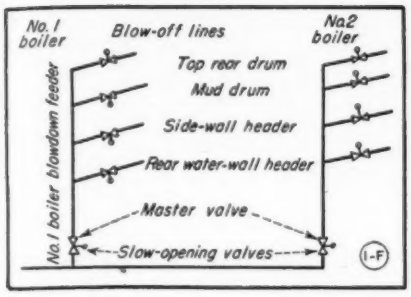
Some one in authority should have a heart-to-heart talk with operators who kick a quick-opening valve closed on a boiler blowoff line. He should explain the terrible chance they are taking when suddenly stopping a high-velocity flow of water under pressure. This creates a great shock to the line and boiler, and can break fittings and pipe connections.

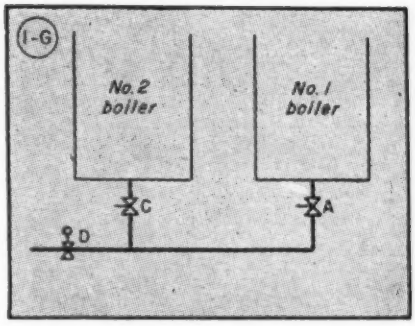
*Memphis, Tenn.* C DEMERE

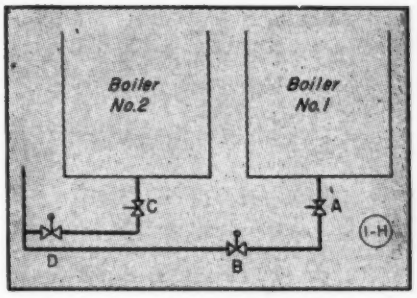
## Try Continuous Blowdown

THE ASME BOILER CODE requires two blowdown valves on each boiler (operating at 100 psi) ahead of the blowdown line, so *WJH* should change his piping as soon as possible.

The method now used to blow down the boiler is indeed dangerous. If no one




is present to watch the gage glass, some way should be devised whereby the fireman can tell how much he is blowing the boiler down. A series of mirrors would show the water level behind the boiler. On some water columns a water glass can be installed in the rear.

Other suggestions are: (1) Install a continuous blowdown line, take boiler-water tests every day, and maintain a certain pH value or concentration, thereby practically eliminating the bottom blowdown of the boiler water. (2) Spray water in the blowdown tank to condense the flash steam.

*Newark, N. J.* R C CONK

## Adopt Master Valve

IF MAXIMUM ALLOWABLE working pressure (safety-valve setting) of these two hrt boilers does not exceed 100 psi, *WJH* may comply with the ASME Code by having slow-opening straight-through valves at *A* and *C*.

The above sketch, 1-*F*, shows how the master-valve idea for several blowdown valves can be applied to several blowdowns from *one* boiler. This practice is permissible. The usual operation is to open the master valve first then open the individual valves, blowing down various parts of the boiler where sludge may accumulate.

*Rolla, Mo.* W H HARVILLE

## Drain Blowdown Line

EACH BOILER should have two valves in the connecting pipe ahead of the blowdown line. The quick-opening valve should be as close to the boiler as possible, and the slow-opening valve should be in series with the quick-opening unit.

If blowdown line is lower than blowdown tank, there should be a drain valve in blowdown line, leading to a drain or sump well. The drain valve should be left open at all times, and should be closed only before the boiler is blown down.

*Oaklyn, N. J.* S W WILKES

## Each Boiler Needs Two Blowoff Valves

THE VALVE ARRANGEMENT in *WJH's* original sketch should certainly be changed and the blowdown operating procedure altered.

In revising the blowoff system I suggest adopting a layout similar to that in sketch 1-*I*. Advantages of this method are: (1) Operator can observe the water glass during blowdown by using handwheel extensions, thus dispensing with the services of a second operator or observer. (2) The system will be in accordance with *ASME Boiler Construction Code*, Paragraph 311(a). Even if the boiler pressure is less than 100 psig, installation of two valves at each boiler provides an individual guard valve in addition to the blowoff valve. (3) If the operating procedure outlined below is followed, at least one tight-seating valve is available on each boiler to eliminate wiredrawing and losses as the result of leaking valves.

In making the changes outlined in sketch 1-*I* observe the following precautions: (1) Present valves should be checked to make sure they are not straight-run globe valves of such type that dams or pockets can exist for the collection of sediment. Such valves should be replaced by standard valves designed for blowoff service. (2) If the present valves are straightaway, Y-type globe or angle valves they can be used in vertical pipes. They can also be used in horizontal runs provided they are constructed or installed so the lowest edge of the opening through the seat is below the center line of the valve. (3) Blowoff piping from the boiler drum to the guard valve should be as prescribed in the *ASME Boiler Construction Code*, Paragraph 310(c). (4) Even though the pressure in the blowoff tank is reduced approximately to atmospheric, the piping and tank should be designed as for steam at 250 psig, based on a boiler pressure below 250 psig. (5) Header should be made ample size. (6) Piping should be supported properly to prevent strain on the boiler due to expansion or contraction. (7) After repiping the system, loosen mill scale and blow out thoroughly.

*Cincinnati, Ohio* W J BURNS

## Relocate One Valve

IF EXISTING VALVES are in good condition and worth retaining, *WJH* can improve his layout by leaving valves *A*, *B*, and *C* as they are and relocating *D*. Not knowing either the length of valve *C* or the height of the line above the floor complicates the problem. If valve *C* is short enough to allow it, the arrangement shown in the sketch 1-*H* is the simplest.

*Dorchester, Mass.* B P NEEDHAM

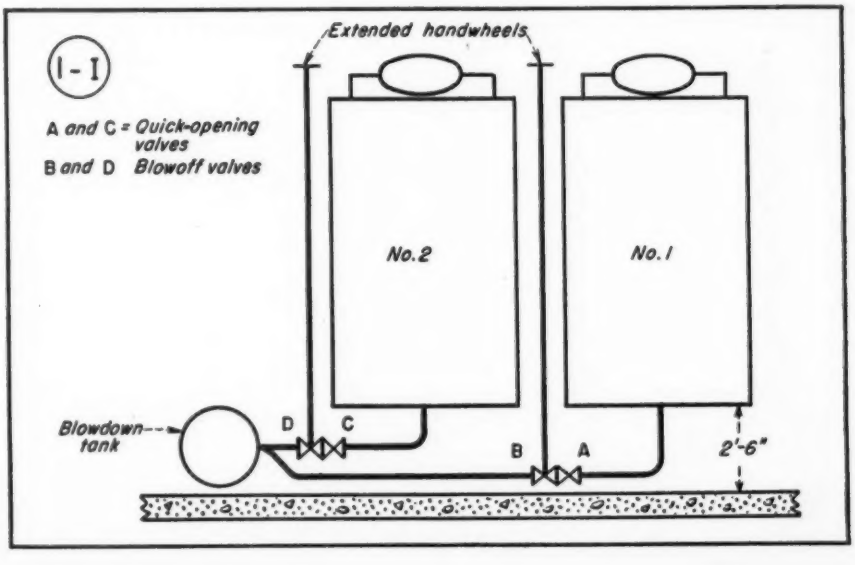
## Use Only Three Valves

THE USUAL RECOMMENDED SEQUENCE for blowing down *WJH's* installation would be: (1) Open valve *C*. (2) Open valve *D*. (3) Open valve *A*. (4) Open valve *B*.

In closing, the sequence should be: (1) Close valve *D*. (2) Close valve *C*. (3) Close Valve *B*. (4) Close valve *A*.

The advantage of this procedure is that

(*Continued on page* 198)



# RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

## 10—Installation and Operation

*In the tenth of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.*

**Q 1—What is the most important consideration in installation of any pump?**

A—No matter how heavy and rigid the pump, it may be seriously distorted when tightening its foundation bolts. To obtain satisfactory service every machine must be firmly and evenly supported. A suitable foundation for a small direct-acting steam pump may be a firm wooden floor. But a heavy foundation of reinforced concrete is required for a large rolling-mill-frame pump. Foundation details are subject to adjustment for local conditions, such as soil and other machinery.

**Q 2—What factors should be considered in selecting location for a pump?**

A—Consider the following factors:

1. Place the pump as near the source of supply as practicable. But do not elevate a unit to get it close to an overhead supply tank, thus reducing suction head.

2. The pump should be accessible for cleaning, regulating, adjustment and repairs. Allow sufficient space for removal of piston rods and other parts.

3. Provide a clean, dry pump room of adequate size for the routine care necessary for satisfactory operation.

**Q 3—Should a horizontal direct-acting steam pump be firmly anchored at both ends?**

A—No, because it must be free to expand under operating temperatures. Usually the liquid-cylinder support

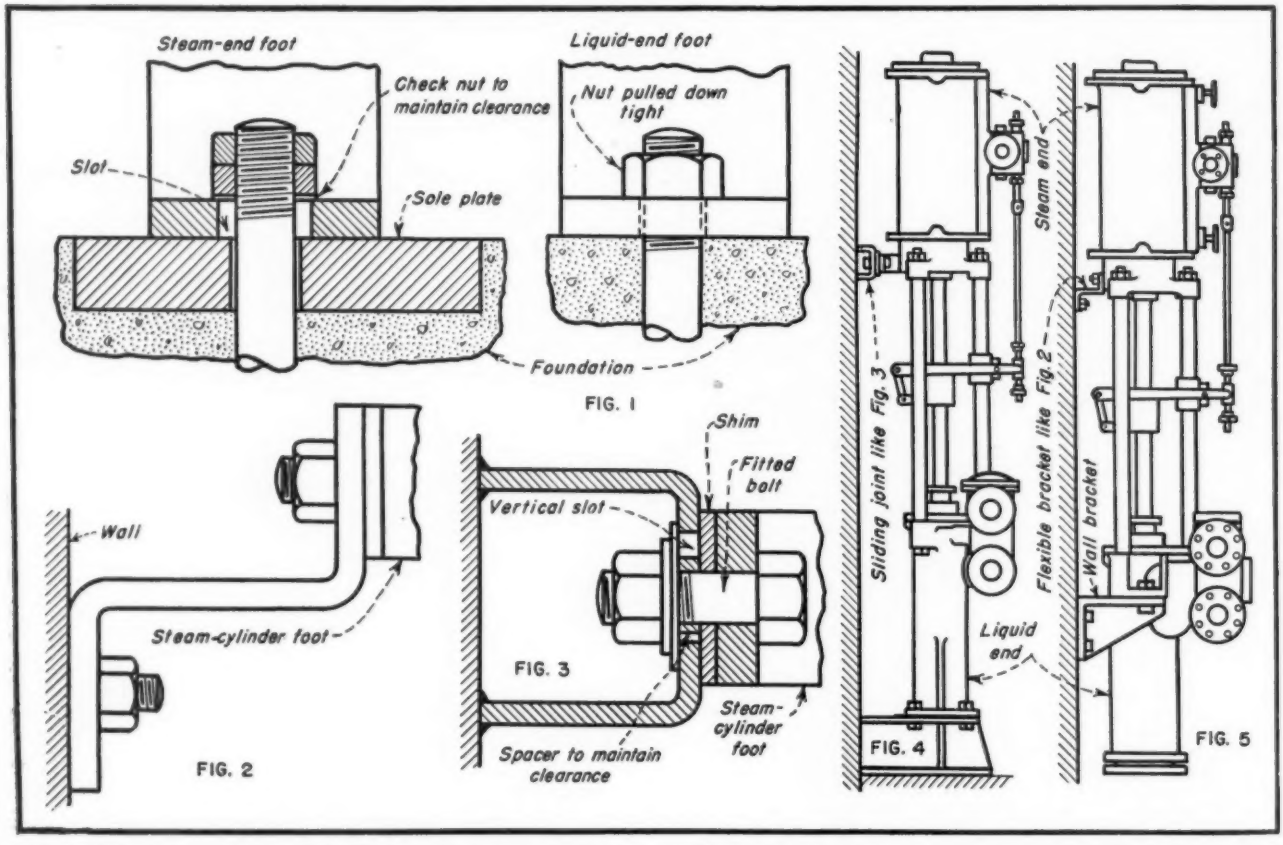



**Fig. 1—Here's a method of fastening the steam and liquid cylinders of a horizontal direct-acting steam pump to their foundation. Fig. 2 and 3—A vertical flexible bracket and sliding-bolt connection, respectively, are used to permit free expansion of the steam cylinder on vertical direct-acting steam pumps. Fig. 4—Lower end of the liquid cylinder of the vertical direct-acting steam pump is supported by integral flange on a foundation. Fig. 5—Direct-acting vertical steam pump supported at upper end of the liquid cylinder on the wall bracket**

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should be firmly bolted to the foundation and the steam-cylinder support provided with a sole plate, Fig. 1, on which it may slide with hold-down bolts, left loose enough to permit free longitudinal movement.

**Q 4—How are vertical direct-acting steam pumps supported?**

A—Primary support of all vertical pumps is at the liquid end. Lower end of liquid cylinder is made with an integral flange or brackets for support by a suitable foundation, Fig. 4. Direct-acting boiler feed pumps are often made with integral brackets at the upper end of the liquid cylinder at about the same height as the suction and discharge piping, Fig. 5. Such design leaves most of this cylinder free to expand downward when heated by the boiler feedwater. The bracket at the steam cylinder end of vertical pumps carries no weight and is arranged merely as a sway brace. Vertically flexible brackets, Fig. 2, or sliding bolts, Fig. 3, are used to permit free expansion.

**Q 5—Are pump flanges heavy enough to support connecting piping?**

A—While most pump flanges support considerable weight in addition to the hydraulic load, it is poor practice to hang the pipe on the pump. Firmly support liquid piping as close to the cylinder as practicable to prevent transmission of forces from piping to pump. Support steam piping a little farther away from the cylinder to permit free expansion of the cylinder and still isolate it from forces caused by expansion of steam and exhaust piping. Where practicable, check all piping for alignment by loosening the joints at the pump when nearly normal operating temperature exists.

**Q 6—What special precautions should be followed in laying a pump's suction line?**

A—Have suction line as short and direct as possible. It should never have a smaller diameter than the suction opening of the pump. Slope it up uniformly to the pump, Fig. 6, to avoid forming an air pocket. If an obstruction must be bypassed, go around it in a horizontal plane rather than over or under to avoid an air pocket, Fig. 7. Make unusually long lines larger than normal size, using an offset fitting at the pump to avoid an air pocket, Fig. 8. When the suction lift is high and the line long, run as much of the pipe as possible at or near suction-well level; then let it rise vertically to the pump, Fig. 8. This will reduce air release from the liquid under reduced pressure. An over-sized foot valve on long lines and high suction lifts helps keep the pump primed.

**Q 7—When should strainers be used in pump suction lines?**

A—Whenever the fluid contains debris or foreign matter that may clog or damage the pump or the pumping system. When water is taken from a lake or river install a strainer or trash rack at the entrance to the suction line. On a ship's bilge pump or on similar units, a strainer is placed at the pump suction connection rather than at the ends of the suction lines leading to various compartments.

Ordinarily strainers are not used in a closed system, such as a boiler feed circuit in a condensing plant. But to catch pipe scale, welding spatter and slag or other dirt in the piping of practically every new system, install a temporary fine-mesh strainer in the suction of each positive displacement pump. This precaution is not needed after the plant has been in operation some time. Such strainers would have saved many a pump liner and piston from early destruction during the recent war ship-building program.

**Q 8—How should the suction connection be arranged at the bottom of a heater or condensate return tank?**

A—When the suction is taken from the tank's bottom, use a riser, Fig. 7. Extend it from one-half to one pipe diameter up into the tank to protect the pump from pipe scale and dirt that accumulates in any return system. Provide a clean-out opening near the suction connection for periodic inspection and removal of foreign matter.

**Q 9—What valves should be used in reciprocating pump piping?**

A—Where the liquid supply is above the pump, use a gate valve in the suction line near the pump. With suction lift, a suction stop valve is not required, although a foot-valve is recommended on the end of long lines and high suction lifts. On the discharge side put a relief valve next to the pump, then a check valve, and finally a gate valve. Where power pumps are to start against load, connect a bypass line of one-half discharge diameter ahead of the check valve. This bypass with its stop valve may connect to the suction side of the pump or return to the suction tank. Do not use globe valves, particularly on the suction side, because of their high friction loss.

**Q 10—What are snifter valves and when are they used?**

A—A snifter valve, Fig. 9, is a screw-down or stop-check valve used on the suction side of a pump to admit air into the suction under certain conditions. They are most useful on drainage pumps, such as bilge pumps on ships, to admit just enough air to cushion the pump at maximum speed, even with long and sometimes restricted suction lines. Individual snifter valves may be used above each suction valve where suction lift is small. Or a single valve

(*Continued on page* 156)

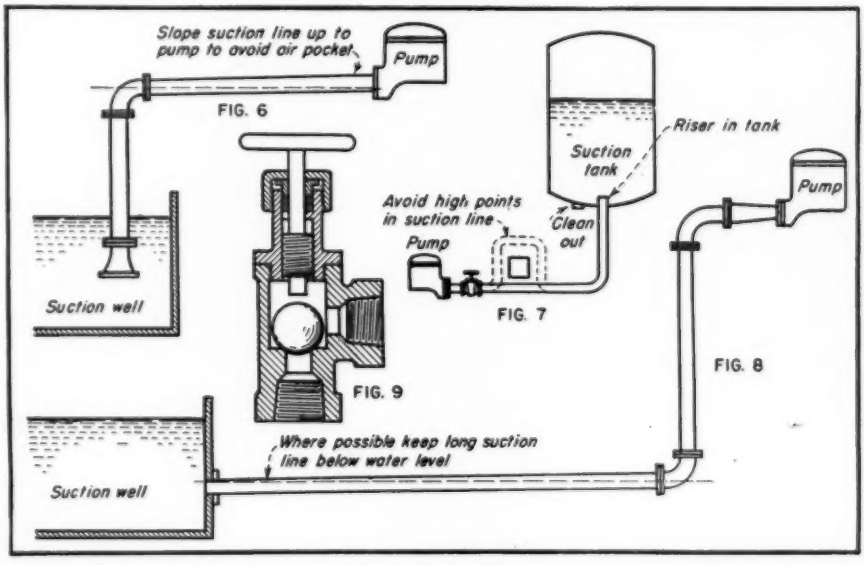


**Fig. 6—Slope suction lines uniformly up to pump to avoid air pockets. Fig. 7—To avoid air pockets, run suction lines in horizontal plane around obstructions rather than under or over them. Fig. 8—When the suction line is long, and the suction lift high, run as much of the pipe at a level near that of the suction well as possible. Fig. 9—Snifter valve used on pump's suction side**

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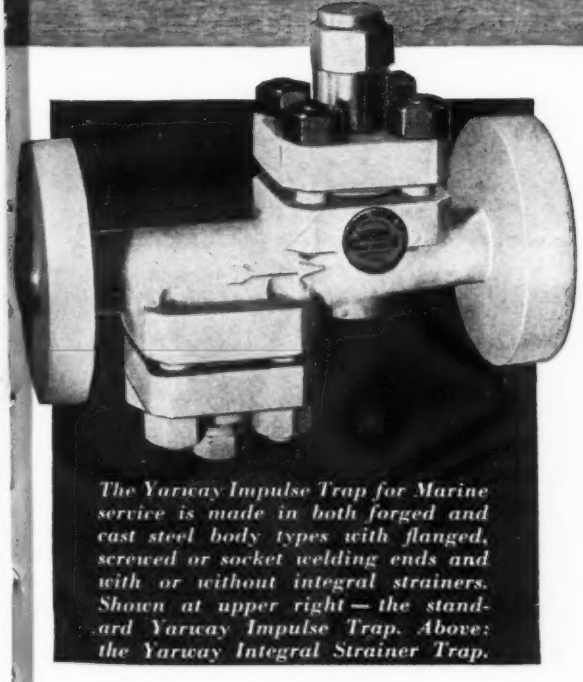

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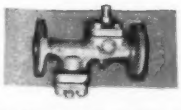
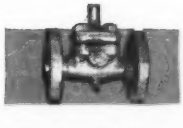
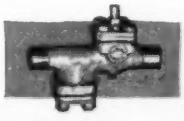


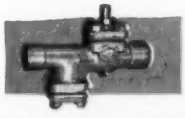
*(Figure No. 140 to 147) Integral Strainer Impulse Trap for pressures up to 600 lb. Steel body, flanged connections.*



*(Figure No. 90 to 97) Impulse Trap for pressures up to 600 lb. (Using separate strainer.) Steel body, flanged connections.*



*(Figure No. 250 to 257) Integral Strainer Impulse Trap for pressures up to 600 lb. Steel body, socket weld connections.*



*(Figure No. 410 to 417) Integral Strainer Impulse Trap for pressures up to 150 lb. Bronze body, screwed connections.*

**YARWAY IMPULSE STEAM TRAP**

# MATH TIPS

**PRIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS**

## MATH TRICKS EXPOSED

▶ To be fair to the busy reader I'll warn him that this month's "Math Tips" are *not* practical. I mean there is nothing on this page you can apply directly to engineering problems. So skip it if you're busy!

My excuse for this discussion is the fact that many engineers, in off-hours, enjoy hairsplitting arguments. I have proof of this, if any is needed, from Arthur Belton of Montreal, Canada. He sent me two sketches, Fig. 1 and 2, with the following comments:

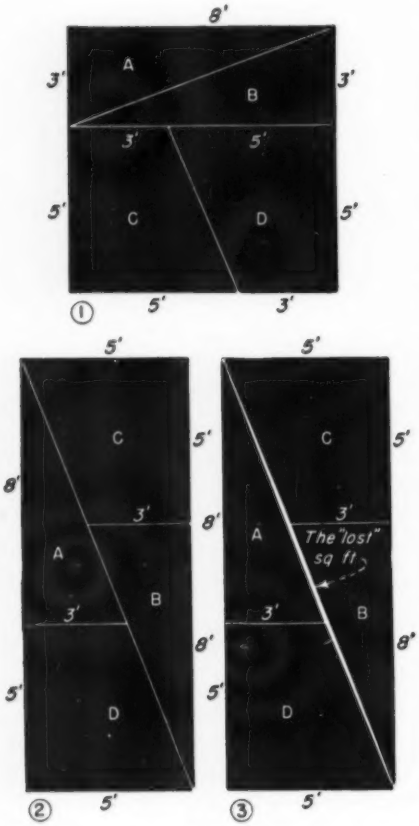



**Fig. 1—Cut the 8x8-ft plate into four pieces of the indicated dimensions. Total area is 8x8=64 sq ft. Fig 2—The boilermaker says he can rearrange the pieces like this to form a rectangle with an area of 5x13=65 sq ft. He asks where the extra square foot comes from. Fig. 3—If this figure is drawn right (true to scale) it will come out as shown above in 3, not as in Fig. 2. The diagonal edges are not in the same straight line. The white space is air, not iron plate, and has an area of one square foot—the missing square foot.**

"The inclosed sketches of the subdivided square and rectangular figures represent four pieces of iron plate. When the plates are arranged to represent a square, Fig. 1, the area is 64 sq ft.

"This problem was given me some years ago by a boilermaker, who drew the two figures on the boiler-room floor, asking me to explain why plates, of the same size as in Fig. 1, add up to 65 sq ft in Fig. 2.

"I can't find an explanation of the extra square foot in the rectangular figure. As you have been explaining geometrical problems in 'Math Tips' I thought it would be a good time to send this problem to Power for an answer."

Okay, Mr. Belton, here goes. What looks like good geometry and good common sense is nothing but a smart, misleading trick. After I explain it you can have a little fun trying it out on some fellow engineer.

Take a long look at Fig. 2. Each piece seems to equal one piece in Fig. 1. Also, it's clear that the outside dimensions of the rectangle are 5 ft and 13 ft, so the area of the rectangle must be 5 x 13 = 65 sq ft. The basic error is the unfounded assumption that the area of the rectangle equals the sum of the areas of the pieces *A*, *B*, *C* and *D*.

Fig. 2 is misleading since it shows *A* and *D* making a flush straight-line joint with *C* and *B*. Actually, the slant edges of *C* and *B* can't be in the same straight line. The same holds for the slant sides of *A* and *D*. The proof is that the slant of *A* and *B* (referred to the long edge of the rectangle) is $\frac{3}{8}$ ft per ft, whereas the slant of *D* and *C* is $\frac{2}{5}$ ft per ft. The difference in slant is 0.025 ft per ft, too small to be noticed in a rough chalk drawing.

To show up the true situation get a drawing board, scale, T-square and triangle (or get some good cross-section paper) and lay Fig. 2 out accurately to scale. Then you will get Fig 3. Note how the slant lines fail to meet. The white sliver in Fig. 3 is the missing square foot.

### FOOL THE GEOMETRY BOYS

If you feel in the mood to confuse some engineer friend who professes a fair knowledge of geometry, test him with this one: In Fig. 4, *BC* is the horizontal diameter of the circle, and *DE* the vertical diameter. Radius of the circle is 6 in.; *DF* is $\frac{7}{8}$ in.; *FG* is horizontal; GH is vertical. What is the length of *FH*?

Many a fairly good mathematician will struggle over this problem a long time. When he gives up, just draw the line *GA*, Fig 5, and recite this little piece: *GFAH* is a rectangle. The diagonals of a rectangle are equal, so *FH* equals *GA*. But *GA* is merely the 6-in. radius of the circle, so *FH* is 6 in."

By the way, note that *FH* will always come out six inches no matter what the value of *DF* is. See Fig. 6.

The trained computer has trouble with this problem because he is looking for something hard, and because he thinks the $\frac{7}{8}$ in. is necessary to a solution.

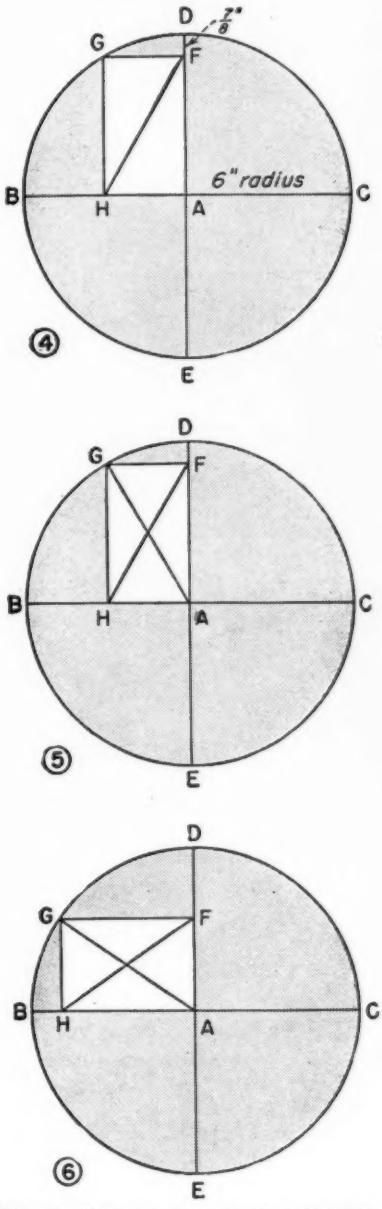
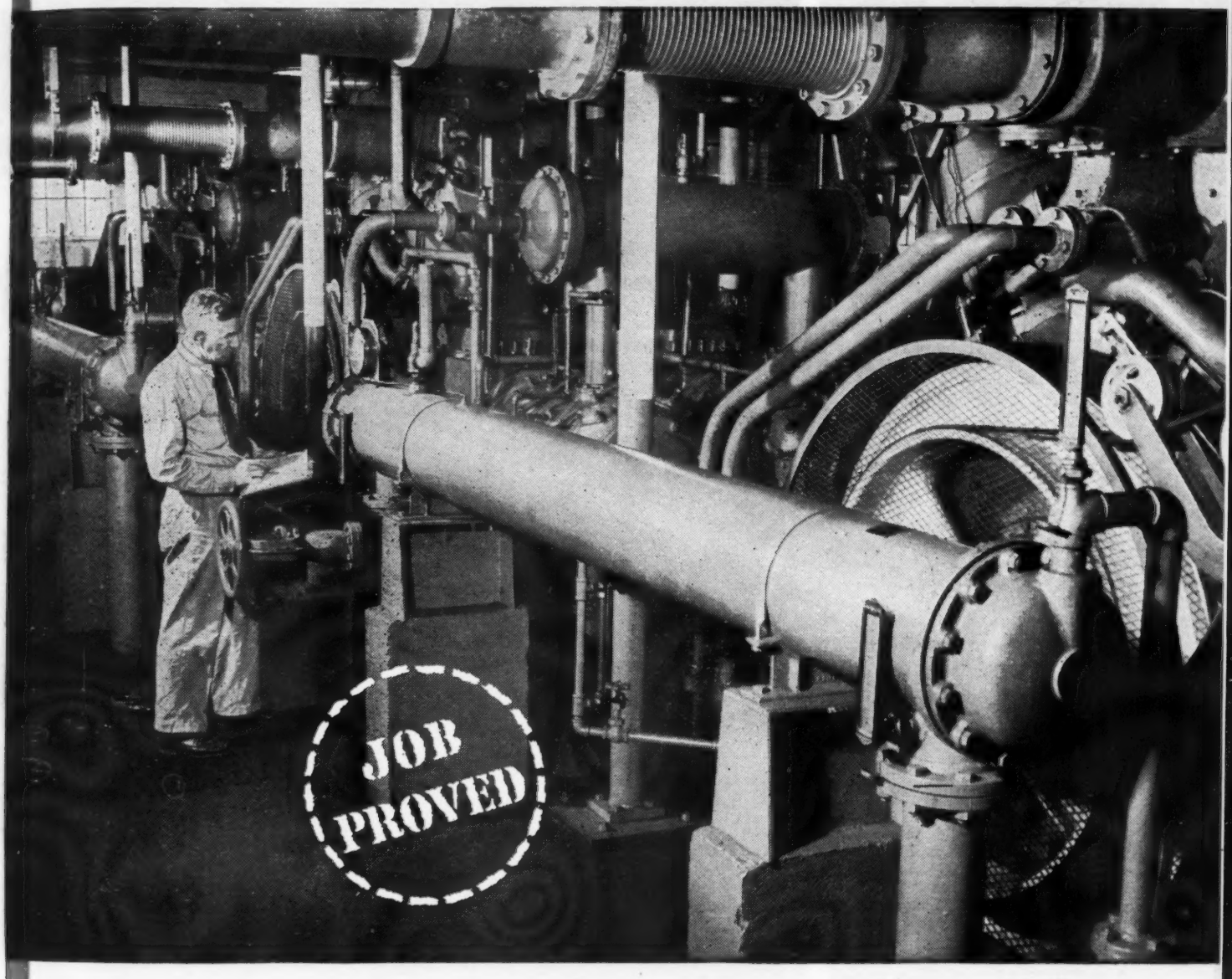



**Fig. 4—Ask your geometer friend to figure the length of the line FH. Fig. 5—Draw GA. FH equals GA because diagonals of any rectangle are equal. So FH equals 6 in. Note that the $\frac{7}{8}$-in. dimension has no part in the problem; it is merely "sucker bait." Fig. 6—For any other value of DF, FH still equals radius of circle.**

# Compressing Maintenance Problems




## SUN COMPRESSOR LUBRICANT...

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**INDUSTRIAL PRODUCTS**

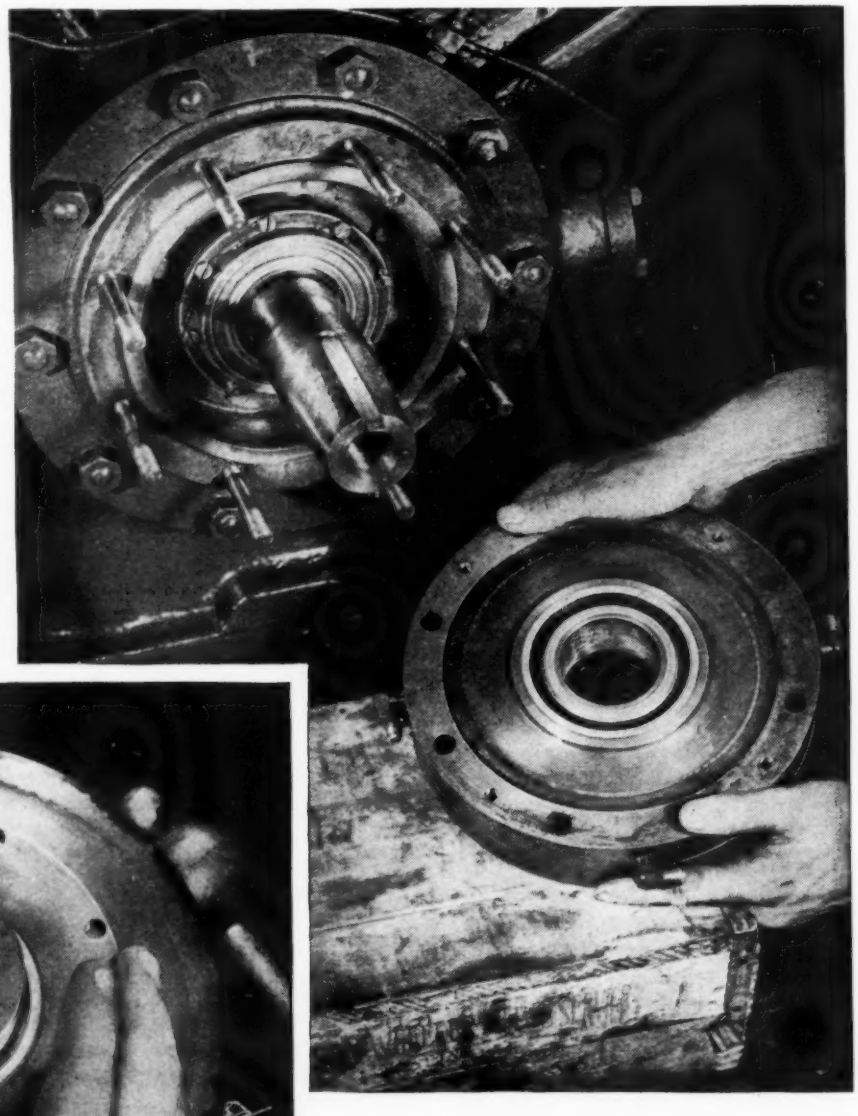
# HOW TO GRIND SEALS ON A COMPRESSOR SHAFT

▶ PREVENTING FREON LEAKAGE at the compressor shaft proved so difficult that special mechanical seals have been developed to replace the conventional packing gland that was widely used on ammonia compressors. Small machines employ a bellows seal, in which any slight shaft movement is taken up by the flexible shell; a spring inside the bellows assures positive seating. Larger sizes use diaphragms or synthetic-rubber rings.

Regardless of slight variations among different manufacturers' designs the actual seal is made between a soft-alloy face, usually stationary, and a hard-steel collar or ring. They are held in contact by coiled springs or the inherent springiness of associated diaphragms. Eventually the seal may leak excessively—an indication that a gasket has failed, a diaphragm has cracked, or that the sealing surfaces no longer contact intimately. Only solution of the latter problem is to lap the surfaces until they mate evenly. Frequent cause of leakage is wear, which forms shoulders on the sliding parts. These defects must be removed before final lapping begins.

Although refacing a seal is a precision job it can be done by a good plant mechanic if he is provided with the necessary tools. Here is the procedure set up by W H MacKenzie, chief engineer, Astor Hotel, New York City, to recondition a seal consisting of two flexible diaphragms. They are attached to bronze rings that bear against hardened collars.

**1** End cap and spacer, which hold the diaphragms and alloy rings, come off as a unit exposing the twin-surface collar bolted to the shaft. A wood filler keeps delicate parts from contacting the sharp edges of the keyway when the seal assembly is removed.



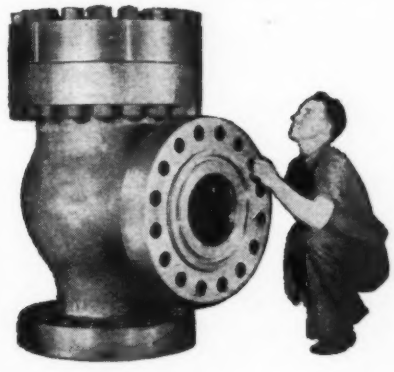
**2** The first step is to remove wear shoulders by grinding them off in a lathe. Next, take a diaphragm-and-ring, and place it upside down on a previously machined boss that fits the ring bore closely. Photo shows shaft collar on the ring in lapping position. Use extremely fine lapping compound and finish the lap with Freon oil to a good, uniform and continuous contact.

Continued on page 122

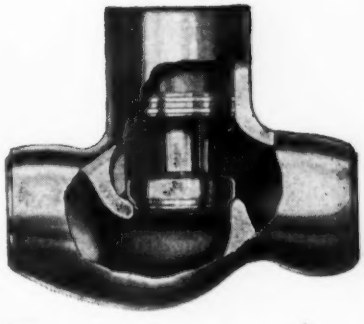
# PIPING FLEXIBILITY *with* Edward *Check Valves*

FOR large, medium or small lines . . . for horizontal, vertical or angle installations . . . for 150 lb to 7500 lb service . . . stainless steel or Stellite trim . . . whether you need flanged, screwed or welding ends—there is an Edward steel check valve to meet your requirements. Many sizes and types are in stock for immediate shipment.

## BIG CHECKS

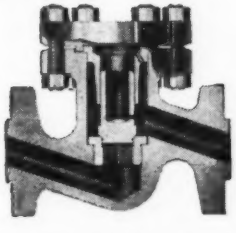


Vibration, clatter and damaging shock to piping are eliminated with Edward piston-type check valves. Integral guide ribs, cored out for free flow, guide the hourglass disk-piston throughout travel to prevent hanging up. New flow contours reduce pressure loss, increase operating efficiency. Built in sizes through 14 in.

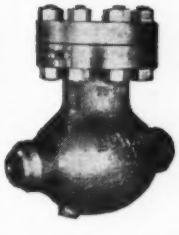


AVAILABLE IN HORIZONTAL ~ . . . ANGLE ⌐ . . . VERTICAL |

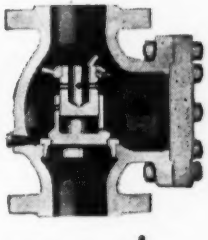
## MEDIUM



Exclusive Edward disk guide lip aids tight seating and cuts wear on seat and disk through momentary throttling action.



Edward check valves may be disassembled without removing from the line. Covers are forged steel.



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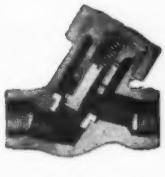
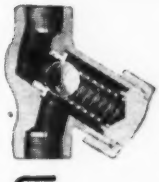
## SMALL

Edward forged steel check valves are spring loaded to insure quick, accurate seating. Bodies are streamlined.



For viscous fluids or hydraulic service, Edward ball checks are ideal. Stainless steel ball is mated to seat.



Design of small Edward checks permits use in either horizontal or vertical lines. Built in sizes down to ¼ in.

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ROCKWELL E V

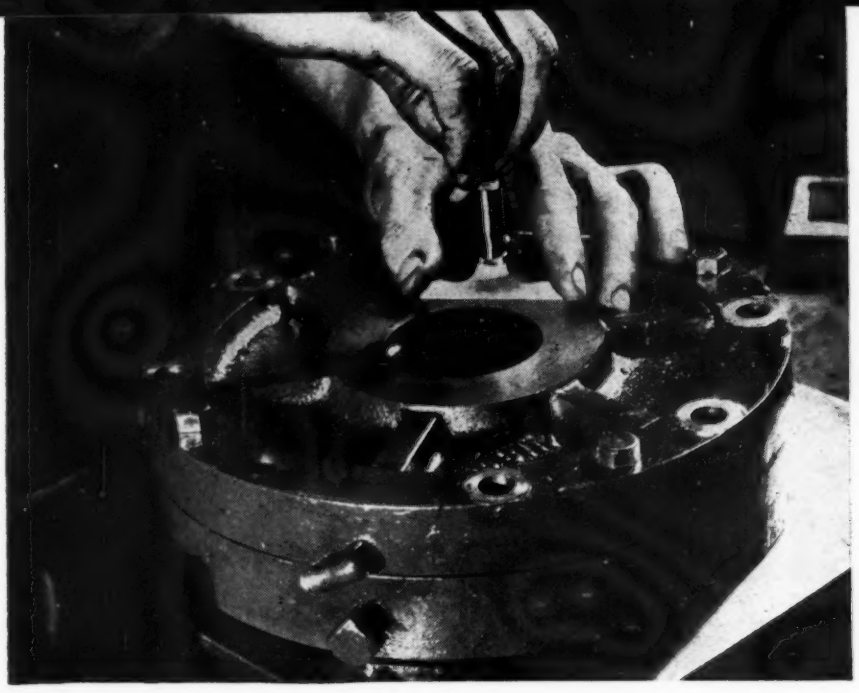
**Edward Valves, Inc.**

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

# HOW TO

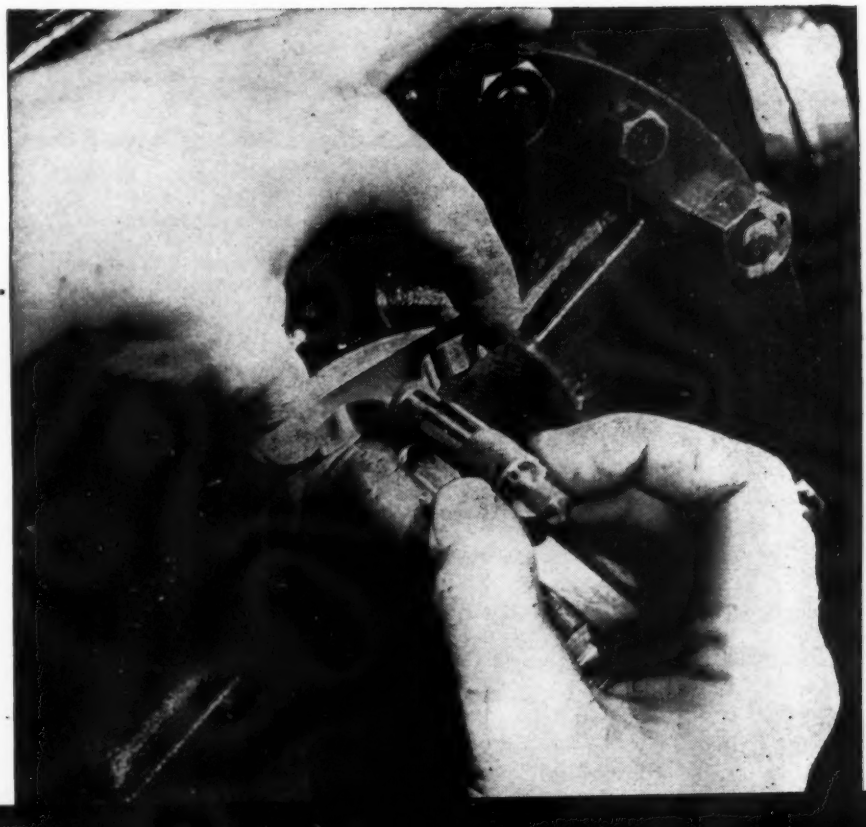
(Continued)

**3** With shaft-seal diaphragm (inner ring) clamped in end plate, place the assembly on a surface plate. Use a depth micrometer to measure the distance between the outer surface and the ring locknut through a hole provided in the cover. Record this measurement as X for checking the final assembly. See photo to right.



**4** After grinding both rings and assembling them in the cover plate, use a straight edge and depth micrometer to measure how far oil-seal ring (outer one) is above shaft seal ring. Adjust gasket thickness under outer diaphragm if distance differs from the manufacturer's recommendations.

**5** Clean all the parts thoroughly with carbon tetrachloride, and cover them with Freon oil for the final assembly. After the end cap is bolted in place, measure it again as in step 3. Record this distance as Y. Then X-Y is the shaft seal (inner ring) tension. Adjust the gasket-thickness between crankcase and adjacent diaphragm to get the proper tension.



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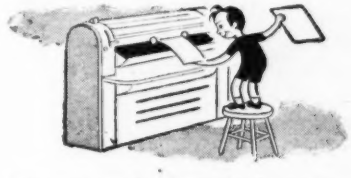

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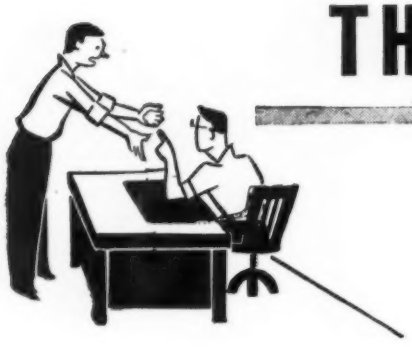

# THE ARGUMENT CORNER

*'Tis here we meet to battle for a pet way to find decimal points or to treat hard water, to drive home pros and cons on soot removal, or to take a close look at other problems*

## Deepwell Pump Is Best for Hard Water

THE FACT THAT THE WATER from *JEC's* well has a hardness of 944 ppm. instead of 94.4 ppm as originally stated. p 114, Jan 1947 POWER. does not change my recommendation against the use of air lift.

This water would certainly be classified as a "very hard water," but deepwell pumps in many places in this country handle water even harder than this without scaling.

*New York, N. Y.* DURANDO MILLER

## Tar's No Problem In Soot Removal

IN YOUR FIRST soot-removal article in the Feb issue, p 74, you say that soot in a coal-fired boiler is somewhat tarry and with fuel oil it tends to be even more tarry. While this statement cannot be disputed on the grounds of chemical analysis, it is a question whether from the angle of effective soot removal this chemically present tarry ingredient in soot should be considered at all.

Temperatures, even in low-pressure heating boilers, are at least 400 F. At this temperature, soot from either coal or fuel oil is dry enough to prevent the infinitesimal proportion of tarry ingredient adhering to the tubes. Thus with either dry steam or air it's no problem to dust off soot from the hot tube surfaces provided boiler doors are closed and the boiler is under fire.

But when a shutdown cools off the boiler, and in addition the doors are open during soot blowing, the dry soot readily absorbs moisture from the outer air. Soot, then, is bound to restore its tarry ingredient to a sticky condition so that some adheres to the tube surfaces. In this case the soot has to be scraped off because a jet of steam or air will not remove it.

The fact is that the presence of a slight tarry ingredient in the soot need not prevent its complete removal from boiler tubes by soot blowers of proper design and effectiveness. This assumes that no moisture is added to the dry soot that exists under boiler-temperature conditions.

*New York, N. Y.* EUGENE HAHN

## Booster for Another Way To Find Decimal Points

TO LOCATE the decimal point in slide-rule calculations, here's what I consider an easier way than that shown on p 126, Jan POWER.

**Multiplications:**

*Problem:* $244 \times 93$ Slide projects left. $3+2=5$ places. Ans, 22,700.

*Problem:* $3042 \times 19{,}862$. Slide projects right. $4+5-1=8$ places. Ans is 60,420,000.

*Problem:* $0.065 \times 4832$. Slide projects left. Since there is no positive digit in .065 and we have one cipher right of decimal point, it is considered a $-1$ digit. Then $-1+4=3$. Ans is 314.

*Problem:* $86.1 \times 4228 \times .069 \times 18.21$. Mental additions are carried along at each slide setting. First, left so $2+4=6$; second, left so $6+(-1)=5$; third, right so $5+2-1=6$. Ans, 457,000.

**Division:**

*Problem:* $\frac{2913}{32.6}$ Slide projects left so $4-2=2$. Ans, 90.4.

*Problem:* $\frac{821.7}{24.6 \times 179.3}$ First setting, $\frac{821.7}{24.6}$ Slide projects right so $3-2+1=2$ places. Second setting, dividing by 179.3 slide still projects right so $2-3+1=0$ places. Ans, .186.

(*Continued on page* 140)

# Copper Tube Pipelines

## offer these three basic advantages

1. **FLEXIBILITY,** in installation and in operation. Bends and offsets to clear beams and girders are readily made in copper tubes; soldered connections can be made in spaces too restricted to manipulate a wrench. Once installed, copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.

2. **MODERATE COST,** for material and for labor. Solder-type fittings eliminate threading, reduce tube weight, require minimum time for layout and installation.

3. **SUPERIOR PERFORMANCE.** Solder fittings give uniformity of bore to copper tube piping; flow is unimpeded at joints, and the rust-free surface of copper means a low coefficient of friction, with reduced pumping costs. The corrosion resistance of copper provides assurance against premature pipe replacement and excessive maintenance cost.

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Write for Publication C-24 on Anaconda Copper Tubes and Fittings.

4730

# WHAT'S New IN PLANT EQUIPMENT

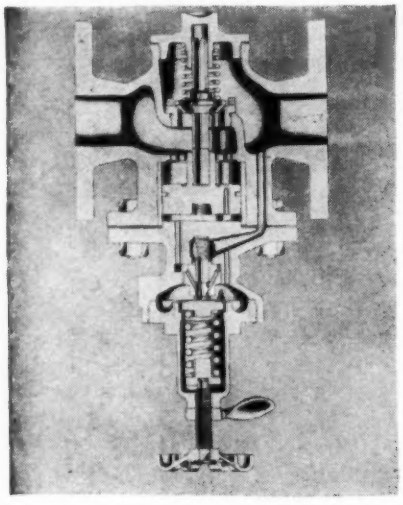
## Draft Gage

MODEL *MZF* ALL-PURPOSE DRAFT GAGE is for all heating plants. This gage is supplied with 9 ft of rubber tubing and a 5-in. metal sampling tube. It serves for readings at point of draft measurement, or placed any distance away from test point. It can be quickly and easily mounted on a panel, or if desired, hung on a wall or set on any flat surface.

Among design features is an exceptionally large area diaphragm inclosed in a metal housing, which is said to assure sustained accuracy and trouble-free service. A 3-in.-wide scale can be read accurately and easily even in dim light. Zero adjustment can be made without removing any parts. Dimensions are $4\frac{3}{4}$x$7\frac{1}{2}$x3 in. The .25-in. range shown in photo is now in production. Other ranges will follow. **Dept P, Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.**

## Welding Electrode

NICAST, a new cast-iron welding electrode, is made to operate on either ac or dc. Resulting welds are strong and nonporous and fully machinable in both the weld and fusion zone areas. Weld deposits can be drilled, tapped, milled or machined in any manner, shape or form. *Nicast* electrode is available in either $\frac{1}{8}$ or 5/32x14-in. sizes. **Dept P, Welding div, Harnischfeger Corp, Milwaukee 14, Wis.**



## Overflow Valve

CLASS *UL* VALVE, for steam, air or gas, is applicable wherever a throttling regulating valve is required to maintain a constant inlet pressure by relieving the excess to a lower-pressure system. A feature of the operation is smooth throttling control during entire cycle of operation, with quick action under sudden pressure variations.

Construction features include high-pressure bronze body, renewable wearing parts, hard-surfaced seat ring, hardened stainless-steel main and controlling valves, bronze piston, corrosion-resistant piston rings, phosphor-bronze diaphragm. This throttling unloading valve is available in sizes from $\frac{1}{2}$ to 4 in., for inlet pressures from 25 to 300 psi, inlet temperature to 550 F, and pressure difference not less than 15 psi. **Dept P, Leslie Co, 50 Delafield Ave, Lyndhurst, N. J.**

## Multi-Breaker

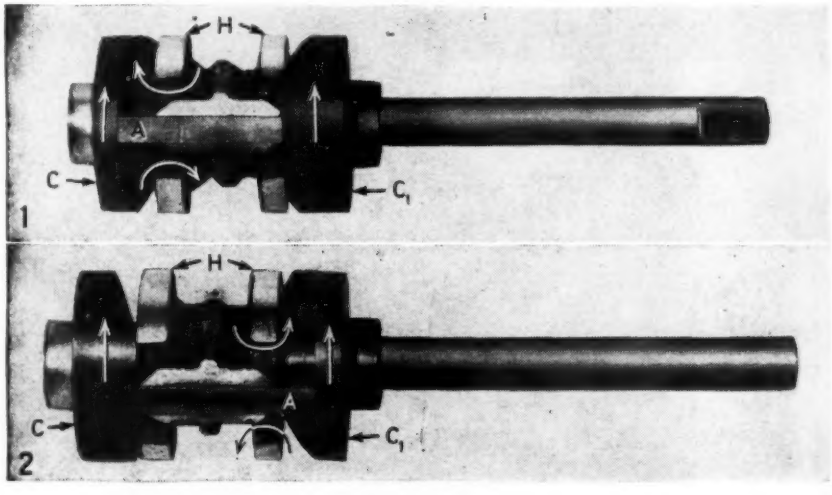
SMALL 4-POLE MULTIBREAKER provides a branch circuit load center for many large installations and also offers fuseless circuit-breaker protection for small homes. The *MO-4* multibreaker combines four breaker poles that serve as single-pole or double-pole circuits by inserting a simple tierod. This breaker incorporates both the well-known thermal overload protection and additional magnetic protection as an added guard against heavy short circuits. Unit has a 50-amp maximum solid rating with individual single poles rated at 15, 20 or 30 amp. **Dept P, Cutler-Hammer, Inc, 294 N 12th St, Milwaukee 1, Wis.**

## Rotary Pump

Built in capacities of 1 to 3500 gpm, this pump is essentially an opposed plunger double-acting reciprocating type operating at high speed. The rotor, Fig. 1, has a hub *H*, free on its shaft and locked in the pump's casing. Cams *C* and $C_1$ are fixed on the shaft and rotate with it. Abutment *A* seals suction from discharge on opposite sides of the casing.

Assume vertical arrows show rotation direction. Then at the rotor's bottom cam *C* is moving toward abutment *A*, and at the top away from it. This causes discharge at the bottom and suction at the top, as indicated by the curved arrows. When the rotor turns one-half revolution, Fig. 2, cam *C* has completed suction and discharge, and cam $C_1$ is active as shown by curved arrows.

Pumps operate at standard-motor speeds for handling a wide-range of liquids, at

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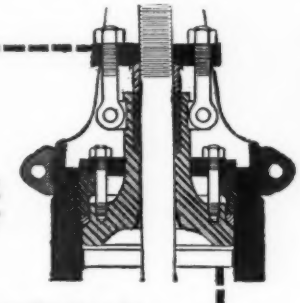
# MORE COMPACT!

## New CRANE *PRESSURE-SEAL BONNET* VALVES

Note comparative dimensions of 1500-Pound Crane Pressure-Seal Steel Gate Valve and of conventional design. Both are 8-inch. In every size, these new valves give you important space-saving advantages. Require less head-room to operate.



***HOW THE LEAK-PROOF PRESSURE-SEAL BONNET JOINT OPERATES***

**Bonnet joint is inside the valve . . . sealed with wedge-shaped seal ring. Fluid pressure in valve automatically keeps bonnet joint tight. No bolts to retain pressure. Leakage is impossible.**

### NEW PERFECTION IN VALVE DESIGN FOR HIGH PRESSURES AND HIGH TEMPERATURES

New streamlined, simplified construction . . . inside and out . . . saves 40 to 60% weight over conventional valves. Inspection is easier . . . insulation is simplified. New disc and seating arrangements assure highly improved operating efficiency. As developed by Crane, the Pressure-Seal principle brings a whole new era in valve engineering and valve performance.

The Crane Pressure-Seal line includes gate, globe, angle, and automatic stop-check patterns with welding ends. Complete information regarding performance and adaptability to your requirements supplied on request. No obligation . . . call your Crane Branch.

*1500-Pound Crane Pressure-Seal Bonnet Globe Valve.*

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

*EVERYTHING FROM . . .*

**VALVES • FITTINGS**
**PIPE • PLUMBING**
**AND HEATING**

# CRANE

*FOR EVERY PIPING SYSTEM*

## Equipment *Continued*

pressures up to 2000 psi and temperatures up to 300 F. They are also built for air compressors for pressures up to 150 psi and as vacuum pumps for vacuums up to 29.5 in. Hg. **Dept P, Deubel Pump & Mfg Co, 369 River Drive, Garfield, N. J.**

## Megohmer

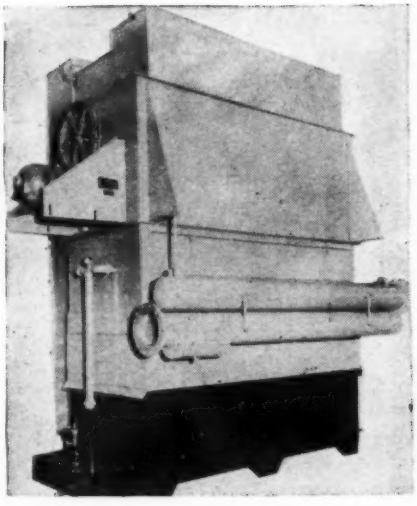
MODEL *B-7* MEGOHMER is a high-quality insulation tester and precision ohmmeter combined. It contains in one instrument two megohm ranges, two ohm ranges, and two test potentials for insulation resistance measurements. Ranges are as follows: 0-200 megohms at 500-v dc, 0-20 megohms at 250-v dc, 0-200 ohms and 0-20,000 ohms. MODEL B-7 employs a vibrator transformer circuit to step up two No. 6 dry-cell batteries connected in series to furnish test potential of 250- and 500-v dc.

Batteries, which are contained in a separate compartment, are easily changed and instrument compartment is sealed by a rubber gasket to protect instrument from dust and moisture. *Model B-7* is built into a strong steel case with a lid, which makes it exceptionally suitable for rough portable service under field and shop conditions. **Dept P, Herman H Sticht Co, 27 Park Place, New York 7, N. Y.**

## Efficient Aftercooler

IMPROVED AERO AFTERCOOLER cools compressed air and condenses and removes water vapor contained in it. Principle of this aftercooler is evaporative cooling of compressed air by passing it through coils in a spray chamber where atmospheric air is drawn through by fans, evaporating a portion of recirculating spray water. The 1000 Btu per lb of water evaporated is removed from compressed air.

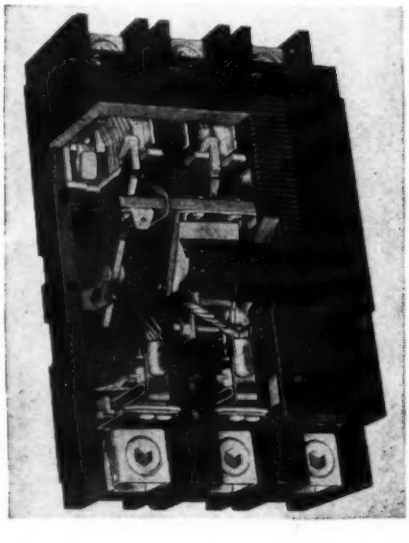
In the newly improved equipment



greater efficiency is obtained by arranging compressed-air coils laterally across spray chamber and introducing compressed air through an oversized manifold, placed lengthwise on outside of casing. The result is said to reduce friction of compressed air in coils and secure greater contact with evaporating spray, thereby bringing compressed-air temperature closer to wet-bulb temperatures of atmospheric air. Since compressed-air temperature reached is always lower than dry-bulb temperature of ambient air, condensation of water in compressed air lines and tools is prevented. **Dept P, Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.**

## Circuit Breaker

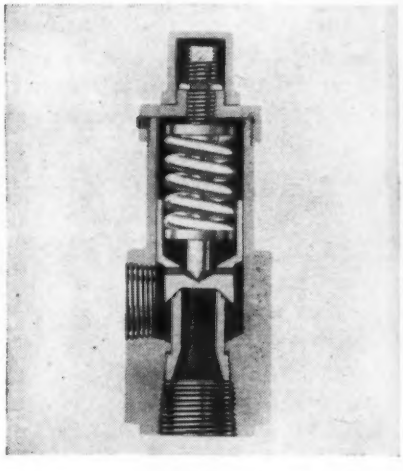
A COMPACT 225-amp frame industrial circuit breaker, known as the *Type ML-3*, is a running mate to the *ML-2*, 100-amp breaker. One outstanding feature is its small size, $10\frac{3}{8}$ in. high x 6 in. wide, about one half the size of the device formerly furnished. A convenient feature is the swing-open hinged-top lug. Thus, cable need only be prepared for installation. Insert it into lug, snap hinge top into position and tighten set screw.



Trip ratings are 125 to 225 amp at 125-250-v dc, 250-v ac, 600-v ac, and 250-v dc. Breaker is available in sheet-steel dust-resisting inclosure with side-operated handle for 3- and 4-wire solid neutral applications in addition to 2- and 3-pole devices. It is also furnished in panelboards and switchboards for front or back connections. **Dept P, Square D Co, 6060 Rivard St, Detroit 11, Mich.**

## Relief Valve

NEW RELIEF VALVE for pressures up to 10,000 psi is fabricated from bar stock, either bronze, cold-rolled steel or stainless steel, depending on the service for which it is intended. Known as *Model No.* 2745,



the valve is available in $\frac{1}{2}$-, $\frac{3}{4}$-, and 1-in. sizes. Interchangeable nozzle inserts provide for proper capacity at set pressures of 2000, 5000 and 10,000 psi for each size. **Dept P, Farris Engrg Corp, 453 Commercial Ave, Palisades Park, N. J.**

## Hand Hoist

Use of steel and aluminum alloys reduces weight of a line of high-speed hand-operated hoists. This makes hoist easy and safe to handle and install. Strength and durability have been increased while excess bulk has been eliminated to produce a compact design. Number of parts has been reduced and all rotating members have precision ball bearings with double sealed-in lifetime lubrication.

Lift wheel, load-chain guide, gearing and load brake have been improved. Minimum pull is required by the operator to unlock brake and lower load. Lowering load is at all times under control, a feature valuable in spotting or assembly work where smooth, easy and accurate movement

(*Continued on page* 160)

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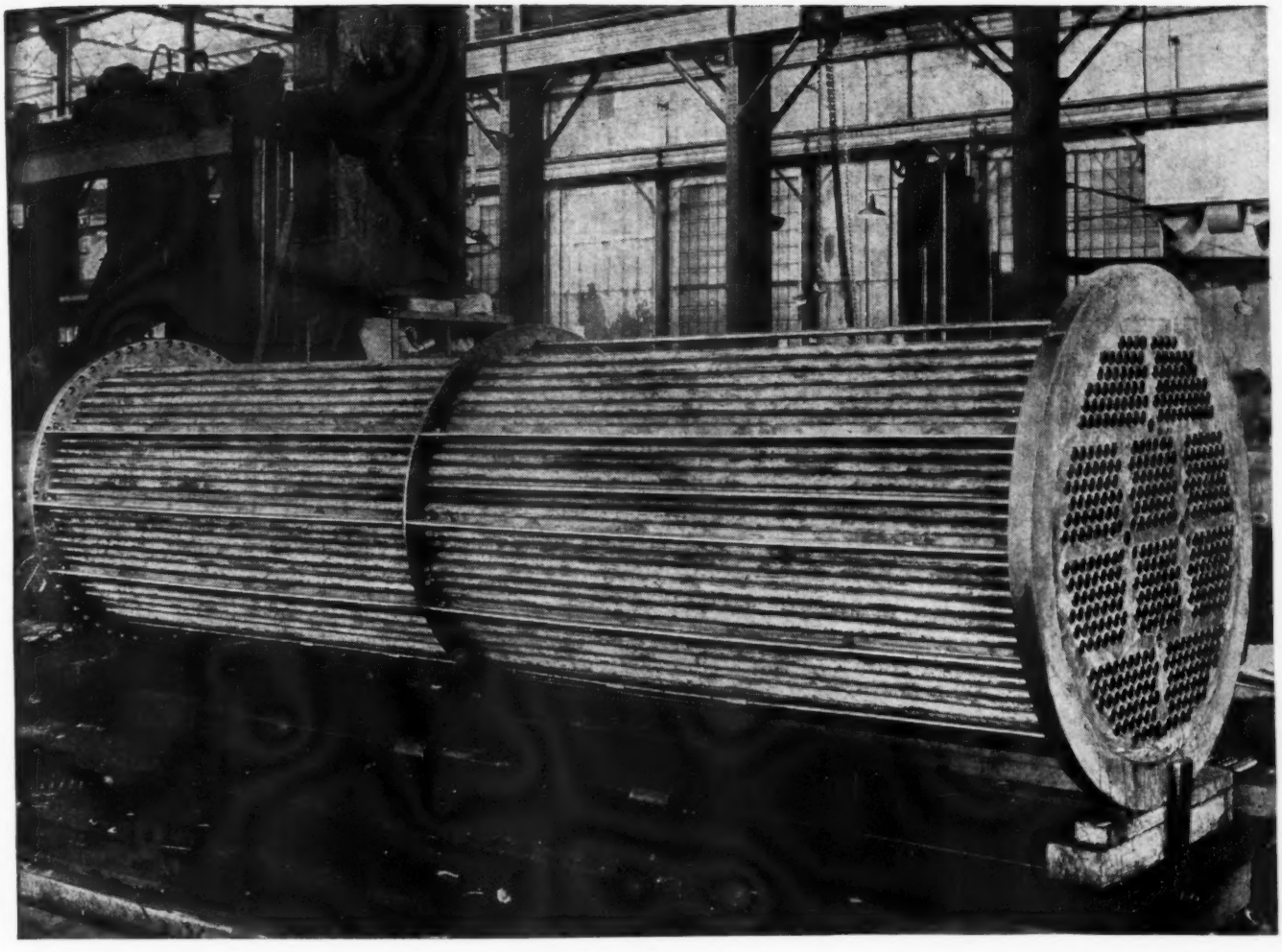

# ELECTRICITY CAN BE CORROSIVE, TOO

OPERATORS of condensers are well-informed and follow sound general practices that should result in satisfactory tube life, but it has been estimated that in about 90% of American plants there is at least one piece of equipment that shows tube trouble. Such cases interest Revere greatly, because we want condenser tubes to give satisfactory, economical service.

Sometimes the causes of premature failure are obscure and difficult to discover. One of them is stray electricity. When you remember that copper plating is usually done at about 4 to 6 volts, you can see that it doesn't take much to move metal from one place to another through a fluid. Any flow of current through a condenser is sure to be destructive.

Electricity often finds strange routes to ground through high-resistance shorts that do not show up through blown fuses, overheated parts, arcing, and similar obvious indications. Pump motors, for example, may work perfectly well, but permit a little "corrosive" electricity to pass along to ground through the condenser; electrolysis results. Galvanic action, due to the use of metals of too-great dissimilarity, may also occur, but is rare in a condenser properly designed for its operating conditions.

So Revere suggests you include electricity as a possibility when seeking the causes of unexpected tube failure. And it is also advisable to save samples cut from failed tubes, to be sent to Revere for laboratory examination. Facts thus scientifically uncovered may lead to recommendations that will solve the problem. If you have a condenser tube problem, ask Revere to help.

**REVERE**

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• • •

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# FOR THE ENGINEER'S BOOKSHELF

**BOOKS REVIEWED IN THIS ISSUE**

**COLLEGE TECHNICAL PHYSICS • POWER FACTOR IN YOUR PLANT**
**APPLIED MATHEMATICS FOR ENGINEERS AND PHYSICISTS**
**ELECTRONICS FOR INDUSTRY • PHOTOELECTRIC CELLS**
**SYMPOSIUM ON TESTING OF BEARINGS**
**NATIONAL ELECTRICAL CODE • APPLIED ENGINEERING MECHANICS**
**THERMODYNAMICS • SERVOMECHANISM FUNDAMENTALS**
**FUNDAMENTALS OF INDUSTRIAL ELECTRONIC CIRCUITS**
**PROGRESS OF STEAM TURBINES (Italian) • PACIFIC DRAINAGE**
**ASTM SPECIFICATIONS FOR STEEL PIPING MATERIALS**

### Introductory Physics

COLLEGE TECHNICAL PHYSICS (1947) *By R L Weber, M W White and K V Manning, all of Pennsylvania State College.* 761 *pp,* 6x9, *illust, tables, cloth.* $4.50. *McGraw-Hill Book Co, Inc,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This book presents the basic ideas of physics for students of science and engineering at the college level. Topics essential for a first-year course are developed in the conventional order. A feature of the book is numerical examples to clarify each principle discussed.

Although algebra and trigonometry are freely used, an attempt has been made to minimize the mathematical difficulties encountered by beginning students. For the benefit of those who need to familiarize themselves with trigonometry a brief discussion is included in the Appendix. Calculus concepts are avoided throughout the book.

### Photoelectric Devices

PHOTOELECTRIC CELLS (1947) *By A Sommer, formerly with Cinema Television Co, Ltd.* 104 *pp,* 5½x8½, 27 *illust, cloth.* $2.75. *Chemical Publishing Co,* 26 *Court St, Brooklyn* 2, *N. Y.*

Photoelectric devices are used extensively in industrial and many other applications. This book treats of tubes of photoelectric emission designs, as distinct from barrier-layer and photo-conducting types. First, the author gives a practical explanation of photoelectric emission, and how it is associated with the electron arrangements of light-sensitive alkali metals. This is followed by details of manufacturing photocathodes and their properties. Vacuum-, gasfilled- and multiplier-tube advantages and limitations are given. The closing chapter, which deals with photoelectric-tube applications, is confined chiefly to tube characteristics rather than circuit design. Written in England, the book naturally represents the thinking and practices of that country. General principles are, however, the same everywhere so those interested in light-sensitive tube will get much helpful information.

### Engineering Thermodynamics

THERMODYNAMICS (1946). *By George A Hawkins, professor of thermodynamics, Purdue University.* 436 *pp,* 5½x8½, *illus, tables, charts, cloth.* $4.50. *John Wiley & Sons, Inc* 440-4*th Ave, New York, N. Y.*

Designed for a 2-semester course in engineering thermodynamics, this text may also be adapted to shorter courses by omitting certain chapters. In line with a trend developing in many schools, the author includes a short introduction to the study of heat transfer. The book is well illustrated throughout and frequent use is made of temperature-entropy and pressure-volume diagrams as well as other useful coordinates.

To define limitations of the ideal gas laws clearly, a discussion of the real gas laws has been included. Relations of available and unavailable energy and entropy are discussed fully to clarify the subject matter. Gas mixtures and gas-and-vapor mixtures are treated at length. A chapter defining the principles of the gas turbine and jet engine is included.

### Applied Mechanics

APPLIED ENGINEERING MECHANICS (1947). *By Alfred Jensen, assistant professor of general engineering, Univ of Washington.* 316 *pp,* 6x9, 478 *illust, cloth.* $3. *McGraw-Hill Book Co, Inc,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This book was prepared in response to requests for a text that would not only meet minimum requirements of the usual college course in mechanics but that would also use a simplified approach needing only an understanding of high-school mathematics. In other words, the text is suitable for college students in engineering and architecture and for those in junior colleges and technical institutes.

First part of the book is devoted to statics and the second to dynamics. To aid the student the more abstract mathematical relations have been minimized in favor of strong emphasis on the physical concepts. Problems commonly appearing in practice have been given more than usual emphasis. Analytical and graphical solutions are given side by side to show their close relationship and encourage the use of both as a check on each other. The text proceeds gradually from elementary subjects to the more difficult.

### Electrical Code

NATIONAL ELECTRICAL CODE (1947 *edition*) 408 *pp,* 6x9 *in. illust,* 34 *tables, cloth.* $2.00. *National Fire Protective Association,* 60 *Batterymarch St, Boston* 10, *Mass.*

Everyone associated with the electrical industry is acquainted with the pocket-size *National Electrical Code* with a paper cover that soon gets badly messed up. Here is a red cloth-bound volume that makes a valuable and attractive addition to the library of any engineer, electrician, or electrical contractor. This edition, which supersedes the 1940 one and interim amendments, was adopted by the National Fire Protective Association at its 1946 meeting. It has also been approved as an American Standard by the American Standards Association. In addition to containing complete *National Electrical Code* rules and requirements with examples, this volume contains an index to all National Fire Protective Association publications and an advertising section of approved products.

### Electronic Circuits

FUNDAMENTALS OF INDUSTRIAL ELECTRONIC CIRCUITS. *By Walther Richter, electrical engineer, Allis-Chalmers Mfg Co,* 569 *pp,* 6x9 *in., illust, cloth.* $4.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

During a comparatively few years an extensive practical literature has been developed around the electron, electron tubes and industrial electronics. This book belongs in that category, even though its treatment is about halfway between the

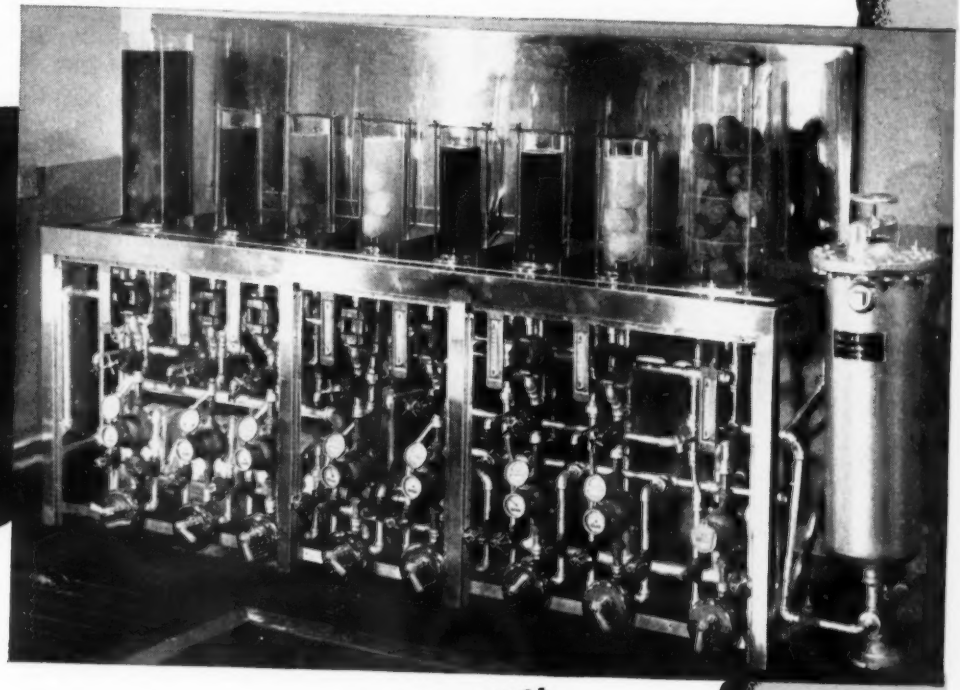
(*Continued on page* 146)

# UTILITY PLANT REPORT:

## No. 7 Boiler in excellent condition after 8 years of operation without acid cleaning or turbining

This report is typical of Nalco System operation in large and small plants. Nalco System users *stay with Nalco* for the obvious reason that *Nalco water treatment gets results.*

Check your plant maintenance and repair records with this example of Nalco water treatment efficiency in mind. If you have scale, corrosion or slime and algae problems, *now* is the time to get a Nalco Survey and recommendations for the beginning of permanently effective water treatment in your plant.



At right is shown one of the pieces of testing equipment in the Nalco Laboratories that help produce the permanent answers to water treatment problems of Nalco System users. This apparatus checks the solubility and dosage rates of Nalco Chemical Balls in Nalco Ball Test Feeders.

**NATIONAL ALUMINATE CORPORATION**
**6222 W. 66th Place, Chicago 38, Illinois**
*Canadian inquiries should be addressed to Aluminate Chemicals, Ltd.,*
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. . . the Scientific System of Water Treatment for All Industry

Nalco

How to plan

# HIGH PRESSURE BOILER BLOWDOWN CONNECTIONS

**Another in the series of basic Piping Layouts prepared by Jenkins Bros.**

A typical blowdown hookup for a plant with two or more boilers operating at a high pressure—in this case 450 psi—is shown in this diagram. It meets the ASME and most other codes, which are rigidly enforced.

**ASME code requirements** call primarily for two valves in tandem on each boiler blowdown line, an independent connection of each blowdown line to the blowdown tank, and use of a blowdown tank. The Jenkins gate valves of cast steel insure tight shut off of the blowdown when not in use and provide unrestricted flow during blowdown. The shock of the blowdown is taken on special blowdown valves. The independent lines make certain that one boiler will not fill or plug the line of the other boiler. A vented tank allows for release of pressure before discharging to sewer and prevents injury to operator.

**The blowdown tank** has a cold water connection—required by many codes—which insures against the discharge of too hot material to the sewer and also serves to dilute sludge and reduce the possibility of sewer clogs. To prevent water hammer, the blowdown is admitted above the water line. Also, to insure against direct discharge of the blowdown through the drainage system, the waste is siphoned off. To meet city codes, the siphon drain is not directly connected with the sewer, thus permitting inspection of flow. The tank has a valved bottom drain for flushing. Check valves prevent flow of cold water to the hot blowdown valves if water level rises too high. City water connection is above water line into a vented tank and has a check valve, meeting anti-contamination requirements.

## Jenkins PRACTICAL PIPING LAYOUTS

**Illustrating the proved 3-point formula for trouble-free, time-defying hookups**

**A** Use the right type valve for the service.
**B** Place valves correctly in the line.
**C** Choose Jenkins Valves for lifetime economy.

**23**

**Fig. 124**
Bronze Y or Blow-off Valve
150 lbs. Steam 300 lbs. O.W.G.

**Other types and pressure ranges** of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

**Copies of Layout No. 23** will be furnished on request . . . also copies of future piping layouts. Just fill out and mail coupon.

**Fig. 124,** the Jenkins Bronze "Y" valve recommended for the drain at the bottom of the tank is especially suited for blowdown service or where mud, grit and dirt are present in water; or where thick, heavy, viscous fluids are handled. Its design allows unobstructed flow comparable to a gate valve and offers the drop tight control feature of a globe valve. The renewable composition disc is for 300 lbs. water pressure. Other discs supplied to order.

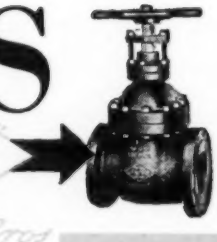
### A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get all advantage of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

# JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864



125 TO 600 LBS. STEAM PRESSURE

TRADE JENKINS MARK
Jenkins Bros

HIGH PRESSURE BOILER BLOWDOWN CONNECTIONS

# HIGH PRESSURE BOILER BLOWDOWN CONNECTIONS

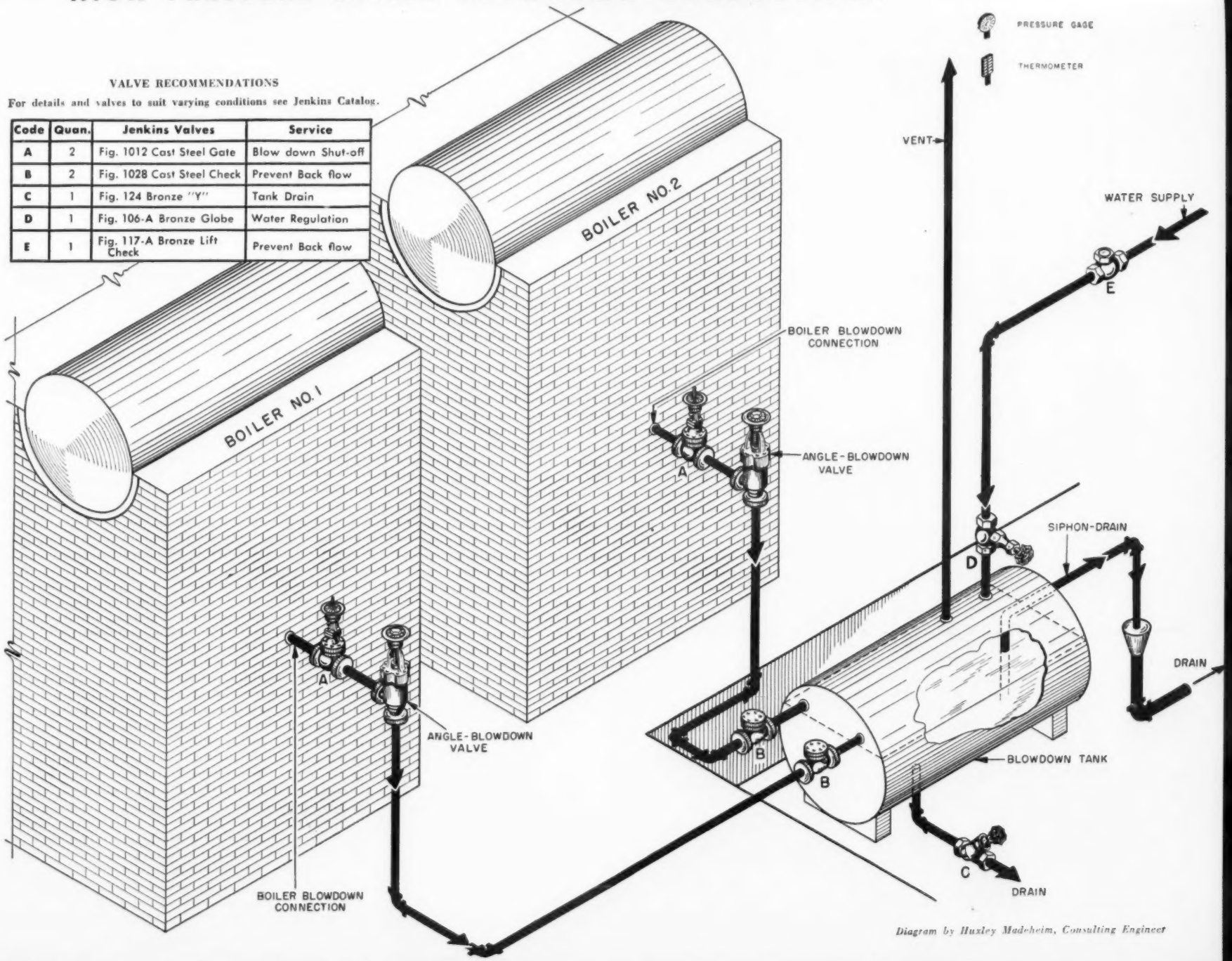



*Diagram by Huxley Madeheim, Consulting Engineer*

**VALVE RECOMMENDATIONS**

For details and valves to suit varying conditions see Jenkins Catalog.

| Code | Quan. | Jenkins Valves | Service |
|---|---|---|---|
| A | 2 | Fig. 1012 Cast Steel Gate | Blow down Shut-off |
| B | 2 | Fig. 1028 Cast Steel Check | Prevent Back flow |
| C | 1 | Fig. 124 Bronze "Y" | Tank Drain |
| D | 1 | Fig. 106-A Bronze Globe | Water Regulation |
| E | 1 | Fig. 117-A Bronze Lift Check | Prevent Back flow |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POWER'S DATA SHEETS

Number 178

# HOW BOILER-WATER IMPURITIES CAN MEASURE STEAM QUALITY

► CHECKING BY ACTUAL TEST against a throttling calorimeter, it was proved that boiler-water impurities can be used to measure accurately steam quality leaving the boiler drum.

Since impurities in the drum water are homogeneously distributed throughout the boiler water, any droplets leaving with the steam carry a proportionate amount of the impurities.

Then measuring concentrations in boiler water and in condensate from a steam sample, the quality can be found from the equation:

$$Q = 100 - \frac{100\ C}{B}$$

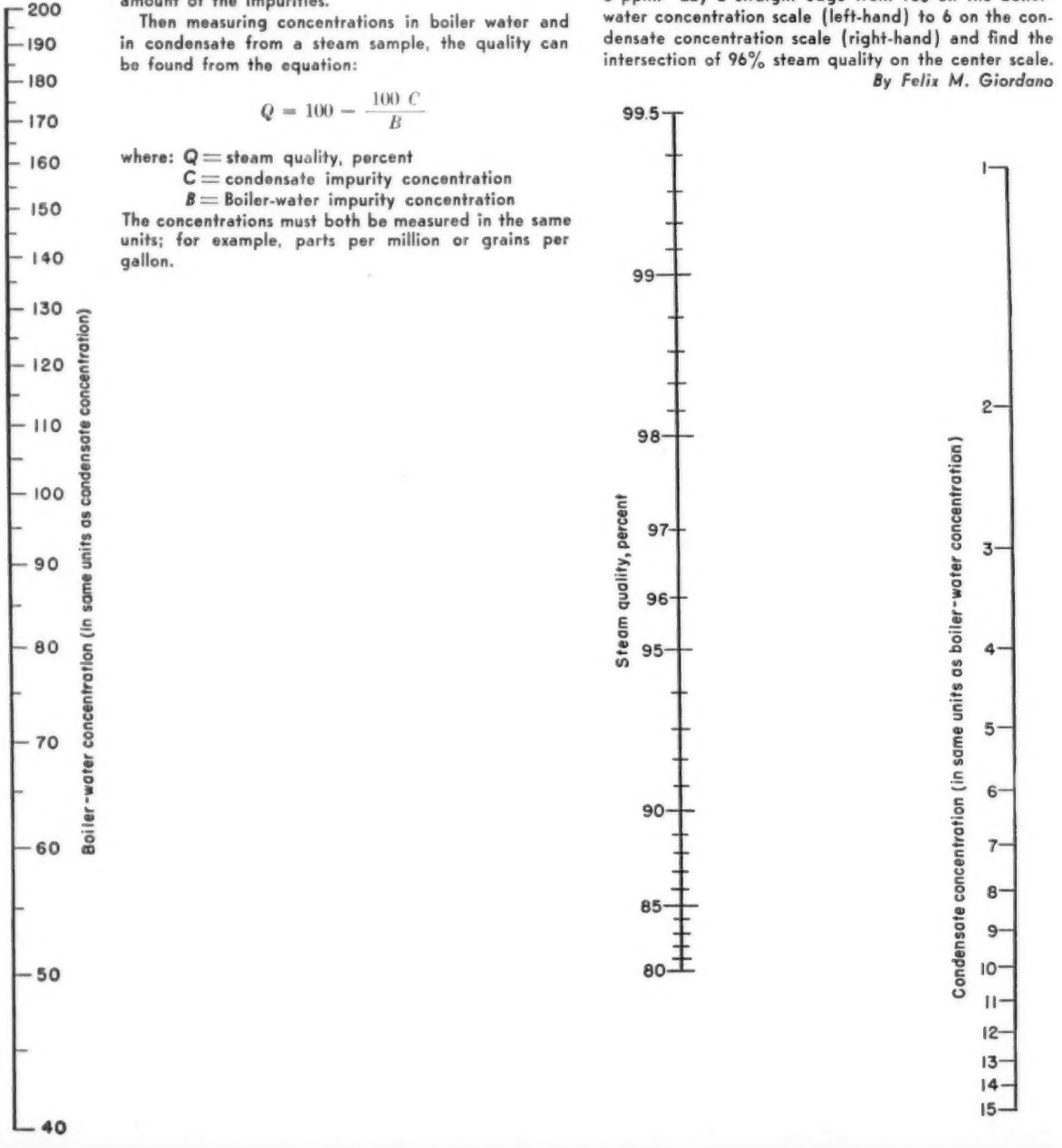
where: $Q$ = steam quality, percent
$C$ = condensate impurity concentration
$B$ = Boiler-water impurity concentration

The concentrations must both be measured in the same units; for example, parts per million or grains per gallon.

This method can be adopted to measure much lower qualities than a throttling calorimeter exhausting to atmosphere. The nomogram below aids quick solution for quality when the concentrations are known.

**Example:** A boiler water sample shows impurities of 150 ppm at the same time that the steam sample was drawn. Condensate of this sample tested to show 6 ppm. Lay a straight edge from 150 on the boiler-water concentration scale (left-hand) to 6 on the condensate concentration scale (right-hand) and find the intersection of 96% steam quality on the center scale.

*By Felix M. Giordano*

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# 1950-1960

The Twentieth Century Fund, a privately-endowed research foundation, has just completed a monumental 875-page work called "America's Needs and Resources." In it is presented a detailed preview of what economic life in the U. S. A. during the 1950-60 decade will be like if we succeed in maintaining high-level employment. From the findings of the Twentieth Century Fund survey, the McGraw-Hill Department of Economics has prepared this synopsis, which highlights points of interest to readers of this magazine.

1940
1950
1960
MORE PEOPLE WORKING . . .
EACH PRODUCING MORE . . .
CAN TURN OUT ENOUGH GOODS AND SERVICES . . .
FOR CONSUMERS, CAPITAL INVESTMENT AND GOVERNMENT
WITH THE RESOURCES AVAILABLE . . .
TO MEET ALMOST ALL OUR NEEDS
NEEDS
PRODUCTION

## POPULATION

A nation's wealth depends more than anything else on the size and vigor of its population. Much of the increase in U. S. production during the past hundred years is a result of a rapid growth in population. This growth supplied manpower for farms and factories and provided an expanding market for consumer goods and services.

***MORE PEOPLE WORKING . .***

Growth was the outstanding fact about population before 1930. The birth rate was almost double the death rate and there was a heavy flow of immigrants. Between 1900 and 1930, the population increase averaged 15 million each decade. Immigration contributed a third of the increase.

But this trend was checked by the depression 30's which stemmed the flood of immigrants and cut the birth rate by forcing postponement of many marriages. As a result, fewer than 9 million persons were added to the population between 1930 and 1940. This was an important factor in prolonging the depression because it slowed the growth of consumer markets.

## WARTIME MARRIAGE BOOM

War and postwar conditions have brought a boom in marriages. They have exceeded normal by more than 1,500,000 since 1940. There will be more newly-married couples in 1950 than ever before and the birth rate may be roughly 10% higher than in the early 1930's. So the 20th Century Fund looks for an increase of 12 million in total population between 1940 and 1950 and a further increase of 10 million in the 1950's.

This will mean a faster-growing market for homes, autos, food, clothing, and other consumer items than we had in the 1930's. It will mean crowded schools and more people seeking jobs.

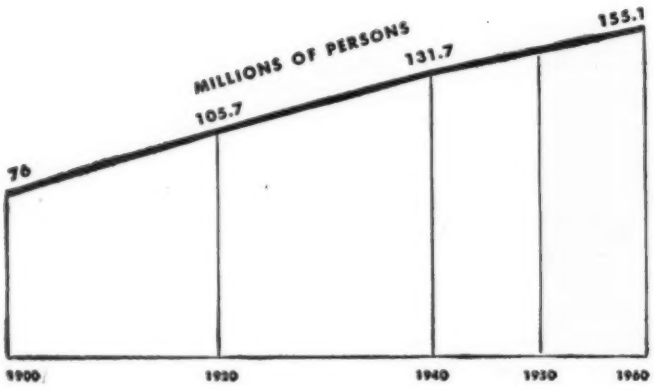
There are four major population trends which will affect markets in the 1950's:

1. The number of families will continue to increase more rapidly than the number of people as families grow smaller. This is significant because the market for housing, appliances, and many other things depends more on the number of families than on the number of people.

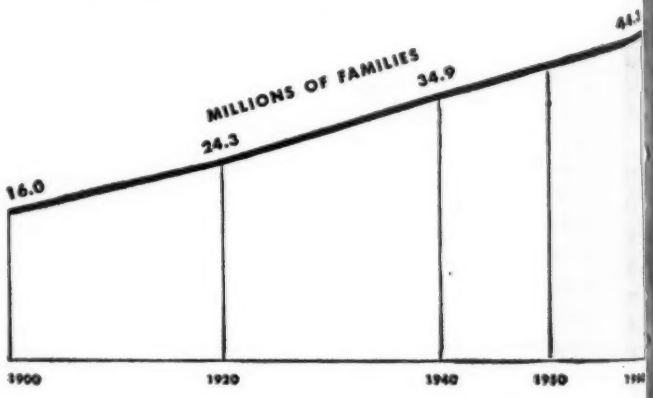
2. Our population will be getting older. But it will not be getting less productive because the proportion of the population between the ages of 20 and 60 will be higher than in past decades. Still, the most striking increase will take place in the number of people over 60—from 14 million in 1940 to more than 20 million in 1960. This will bring greater demand for medical services and social security. An important cause of this trend is our success in controlling communicable disease. The following table shows how the death rate from selected causes has changed since 1900.

| | *Death Rate Per 100,000 Persons* | |
|---|---|---|
| | *1942* | *1900* |
| Diseases of heart | 295 | 137 |
| Cancer and other malignant tumors | 122 | 64 |
| Influenza | 56 | 202 |
| Tuberculosis | 43 | 194 |
| Diarrhea and enteritis | 9 | 143 |
| Whooping cough | 2 | 12 |
| Diphtheria | 1 | 40 |
| Measles | 1 | 13 |
| Typhoid and paratyphoid fever | 0.5 | 31 |
| Scarlet fever | 0.3 | 10 |
| Other | 505.2 | 873 |
| | 1035.0 | 1719 |

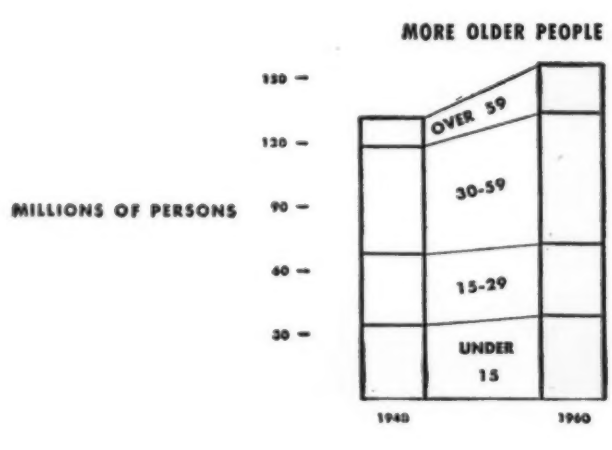
**TWICE AS MANY PEOPLE**



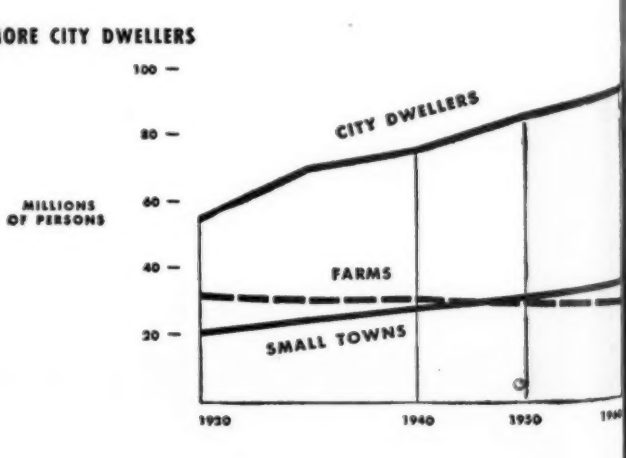

**BUT THREE TIMES AS MANY FAMILIES**



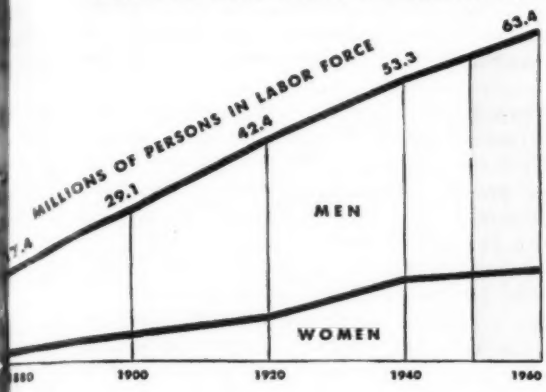

**MORE OLDER PEOPLE**



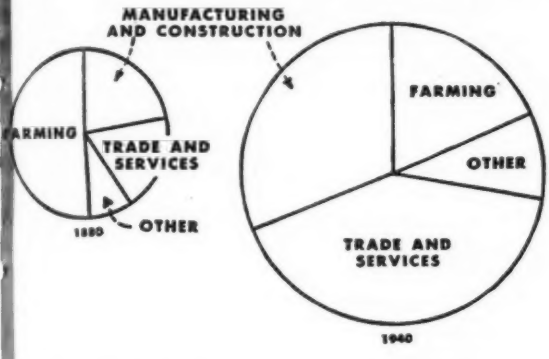

**MORE CITY DWELLERS**



MORE AND MORE WOMEN ARE SEEKING JOBS

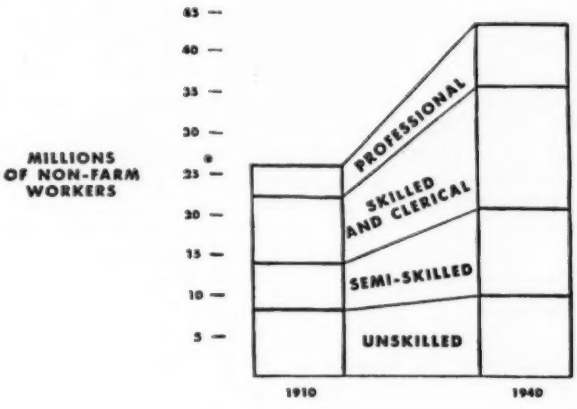



FARMING IS GIVING WAY TO OTHER OCCUPATIONS




ANATOMY OF THE LABOR FORCE

THE LABOR FORCE IS GROWING MORE SKILLED




3. The population will continue to become more urbanized. Small and medium-sized cities will grow faster than the largest cities. The general westward migration which was accelerated by the war will continue.

4. Our people will keep on getting more homogeneous. There has been almost no immigration since 1929, so the number of immigrants who have been in the country for less than 20 years will make up less than one percent of the population in 1950 as against 10% in 1930.

An even more important factor in making the population all of a kind has been the growth of universal education. The proportion of children 14-17 years old attending high school doubled between 1920 and 1936. The rise of the radio, movies, and national magazines has also levelled us out. These developments not only raise the general educational level of the nation but also tend to standardize the public's tastes and attitudes.

## LABOR FORCE

The volume of goods and services produced by 145 million persons in 1950 and 155 million in 1960 will depend on what share of the population is in the labor market and the amount of work those employed actually do. The proportion of the population in the labor force has shown little change in the past few decades. So the 20th Century Fund assumes that the relationship between labor force and population will be about the same in 1950 and 1960 as it was just before the war. On this basis 60 million people will be in the labor market in 1950 and 63.4 million ten years later.

As you can see from the charts, however, there will be several important changes in the composition of the labor force. More women will be working. In 1870 only one out of every eight worked. By 1940 the proportion had grown to one out of four, and evidently will go on rising.

However, the increase in the number of women working will just about be offset by earlier retirements and longer schooling. This explains why there is little change in the ratio of labor force to population.

## UNEMPLOYMENT

The effectiveness of the labor force depends not only on its size but on how fully it is employed. We have never had full employment in the sense that everyone able and willing to work had a job at the same time. Even in good years unemployment has seldom averaged less than 5% of the working force because workers are always moving from job to job. And in 1932, nearly one-fourth of all workers were unable to find jobs.

For this reason, the 20th Century Fund assumes that, even with good business in the 1950s, unemployment will average 5% of the labor force. This works out to 3 million unemployed in 1950.

In addition, the Fund expects the long down-trend in average weekly hours to continue. A century ago, workers put in a 12 hour day for 6 days a week. By 1940 the average work-week had declined to 44 hours in non-agricultural jobs and 52 hours in agriculture. If this trend continues, the average in non-farm jobs will be down to 38 hours a week in 1960, and farmers will work 48 hours.

Adding all this up, and allowing for vacations, absenteeism, and sickness, the 20th Century Fund estimates that the U. S. will put in 121 billion man-hours of work in 1950 and 118 billion in 1960. This compares with 105 billion in 1940 and with 154 billion at the peak of the war effort. The quantity of goods and services that can be turned out with this amount of labor effort will depend on average output per man-hour, or productivity.

## PRODUCTIVITY

The key to our future economic welfare is productivity. It is the five-fold increase in output per man-hour that has made it possible for us to work shorter hours and still enjoy a rising standard of living. This increase in productivity has been accomplished not by working harder but by constantly inventing better machinery to supplement human energy with mechanical power.

Of course, in any specific factory at any given time, productivity depends largely on the willingness and ability of labor and management. But over the years, the actual effort of the individual worker becomes much less important than the effort of the machine. The most energetic and skilled blacksmith of a century ago could not remotely approach the productivity of today's semi-skilled worker operating automatic power-driven equipment.

**EACH PRODUCING MORE . . .**

In 1860, the average worker turned out 33¢ (in 1944 dollars) worth of goods in an hour. By 1940, this had grown to $1.22. This sensational increase in productivity was due to the increased use of power-driven machines. In 1860, the average worker had the help of only half a horsepower of animal or mineral energy. In 1940, he had the use of 2.7 horsepower. To put it another way, if there had been no increase in the use of mechanical power since 1850, it would have taken 290 million workers to turn out the amount of goods and services actually produced at the peak of the war effort by only 63 million workers.

## DO MACHINES KILL JOBS

Past history also shows that we need not fear the long run effects of the introduction of labor-saving machines. On the contrary, the only way we can improve the material welfare of everyone is to continue and even step up the rate at which we save labor by using machines.

Some people, it is true, are thrown out of work and a few of them may not be able to find other jobs easily. But mechanization more than compensates for "technological unemployment" by making it possible to produce more and better things for everyone—things that themselves create jobs. Development of the railroads and the automobile, for example, put a lot of canal boat and livery stable operators out of business. But it cut the cost of transportation and created many times more jobs than it eliminated.

The 20th Century Fund also points out that the most important reason that the technological revolution developed luxuriantly in the U. S. between 1850 and 1940 was that competitive enterprise provided a generally favorable climate. It is true that natural resources were plentiful and that the population was growing rapidly both in numbers and in skill. But what we had to a unique degree here was an atmosphere which favored risk-taking, fostered the vast capital investment necessary to harness and apply mechanical energy, and provided the incentives necessary to put capital and inventiveness to work.

No other economy has equalled ours in the ability to produce more and more with continually diminishing human effort. The test it now faces is whether it can eliminate the ups and downs in production and employment that have gone along with it. But an abundance of evidence indicates that we ran into trouble after 1929 not because we developed t many labor-saving machines but because we didn adjust our economic mechanism to keep the proce going.

The key importance of mechanization is indicate by the fact that the increase in national productio since 1860 closely parallels the increase in use of m chanical power. Between 1860 and 1940, both volum of production and use of energy multiplied abou 11 times. It is clear that, in order to keep our stand ard of living rising, we must continue to apply mor and more power to production.

Chief advantage of mechanical energy is, o course, its low cost. Electric energy is now delivere for as little as a cent a horsepower, while the same amount of human energy costs $10.

And there are other important advantages. Mechani cal energy can be delivered in greater concentration than any other form. It is also more convenient, com pact, mobile, and controllable. Consolidated Edison i New York delivers enough electricity in a day to d the work of 3 million draft horses.

These advantages are now so universally accepte that it's hard to realize how recently we left the hors and buggy era. At the turn of the century, animals an men provided more than half the energy used i production and transportation. It wasn't until Worl War I that trucks replaced horses in local hauling an tractors began to invade the farms. Here is how th use of mechanical energy has grown since 1850:

| | Total Energy Output (Billions of Horsepower-Hours) | Percent Supplied by: | | |
|---|---|---|---|---|
| | | Mechanical Energy | Humans | Anim |
| 1850 | 17.6 | 6 | 15 | 79 |
| 1860 | 25.2 | 7 | 14 | 79 |
| 1870 | 27.8 | 12 | 15 | 73 |
| 1880 | 39.9 | 17 | 14 | 69 |
| 1890 | 61.1 | 28 | 12 | 60 |
| 1900 | 82.9 | 38 | 10 | 51 |
| 1910 | 131.4 | 57 | 8 | 35 |
| 1920 | 197.4 | 73 | 6 | 21 |
| 1930 | 238.3 | 84 | 5 | 11 |
| 1940 | 289.4 | 90 | 4 | 6 |
| 1950 | 410.4 | 94 | 3 | 3 |
| 1960 | 489.8 | 96 | 2 | 2 |

## PRODUCTIVITY IN THE FUTURE

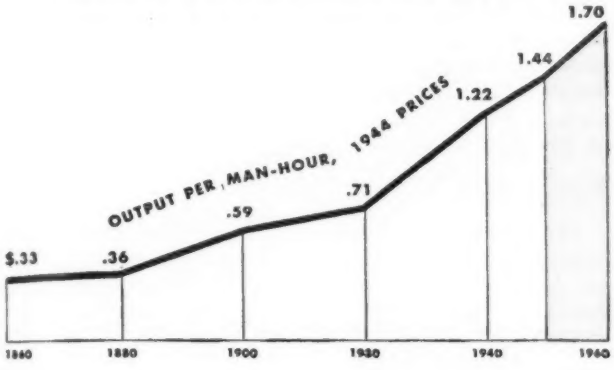
Any attempt to predict future developments i productivity is complicated by the fact that th changes do not occur at an even rate. Between 18 and 1940 the average increase in output per man hour was 18% per decade. But the changes varie all the way from 3% between 1870 and 1880 to 42 for the decade ending in 1940. There is, therefor no simple way to extend past trends to obtain a foo proof figure for productivity at a future date.

For purposes of this study, however, the 20t Century Fund assumes that the average rate of in crease since 1850 may be projected to estimate outpu per man-hour in 1950 and 1960. Thus, output per man hour works out to $1.44 in 1950 and $1.70 in 1960 against $1.22 in 1940 (all in 1944 dollars).

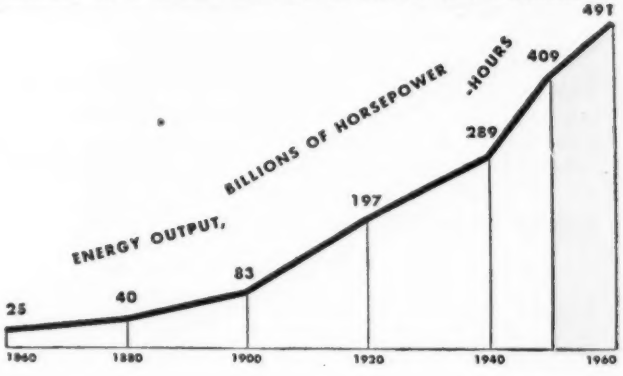
As the Fund points out, this is a critical assump tion, and it is further complicated by the fact tha there is a wider possibility of error in this estimat than in most of the others in the study. If, for ex ample, it is assumed that productivity will increase the pace set from 1920 to 1940 which averaged 36% per decade, then 1960 production would be abou double the 1940 level instead of only 157% of it, the 20th Century Fund estimates.

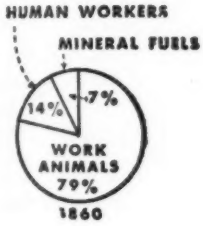
# A CENTURY OF ECONOMIC PROGRESS 1860 – 1960

## OUTPUT PER MAN-HOUR SHOULD BE 5 TIMES AS GREAT

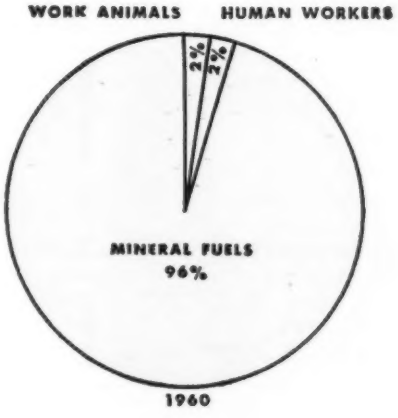



## BECAUSE OF A STEADY GROWTH OF POWER AND MACHINES

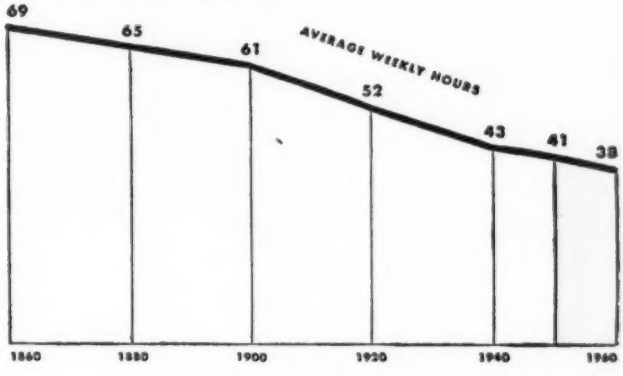


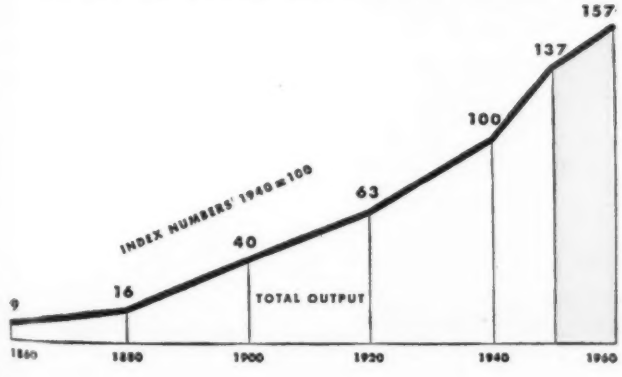

## SO WITH LESS EFFORT



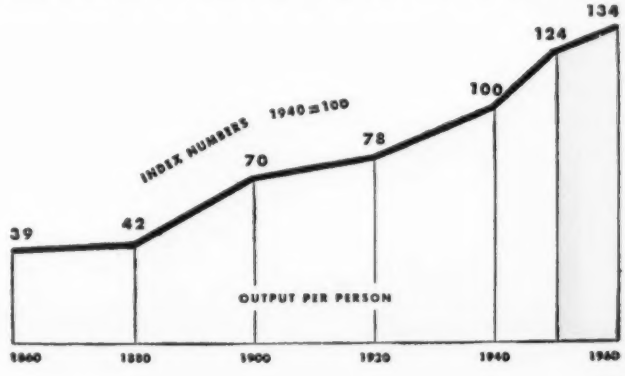

## AND A SHORTER WORK WEEK




## 6 TIMES AS MANY WORKERS CAN PRODUCE 17 TIMES AS MUCH




## AND PROVIDE 3½ TIMES AS MUCH OUTPUT FOR EACH PERSON



## TOTAL NATIONAL OUTPUT

The potential volume of goods and services in 1950 and 1960 can be determined by simple arithmetic, using the assumptions outlined on the preceding pages. Of an estimated population of 145 million in 1950, about 60 million persons will be in the labor market and 57 million of them will have jobs if we succeed in keeping business activity at a high level.

This many people would work 121 billion man-hours. With output per man-hour estimated at $1.44 (in 1944 dollars) the total value of goods and services produced, or the gross national product, would come to $177 billion. Similar calculations yield a gross national product of $202 billion for 1960.

As the 20th Century Fund emphasizes, these estimates are neither a forecast of actual production nor an appraisal of maximum potential production. They are merely an attempt to show in dollars and cents what can be achieved with high-level employment.

## HIGHER LIVING STANDARDS

Compared with any prewar year, a gross national product of $177 billion in 1950 and $202 billion in 1960 would represent a handsome gain. It would make possible a substantial rise in living standards. In 1950 we would produce a fifth more than in 1941.

***CAN TURN OUT ENOUGH GOODS AND SERVICES . . .***

However, the volume of goods and services turned out in 1950 would be only slightly higher than present production. This is because the number of persons at work today is 2 million above the estimated normal for 1950, and average weekly hours are higher than they will be then. Almost a million and a half of the emergency workers drawn into the labor force during the war are still at work and unemployment is lower than the figure assumed for 1950.

The estimates of 1950 and 1960 gross national product, as well as the figures for past years used in the chart, are expressed in 1944 prices. This is not a prediction that the price level will settle down to the 1944 level which would involve a drop of 18% in the cost of living and 26% in wholesale prices. It is merely a device to eliminate price fluctuations so that the figures will show only the actual changes in the physical volume of production.

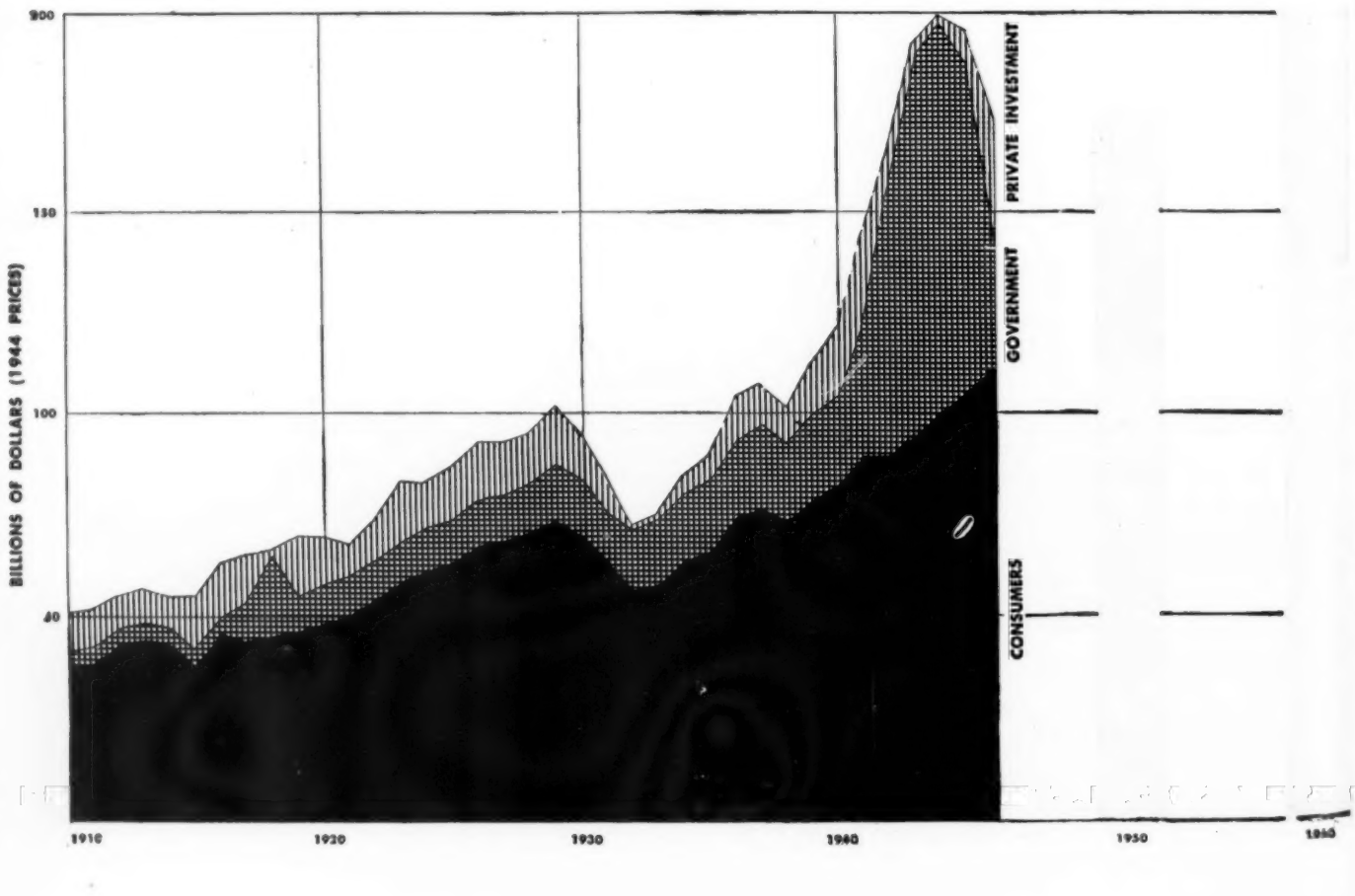
Gross national product measures the total market value of everything the nation produces. All the goods and services produced are absorbed in one of three ways: by consumer expenditures; by expenditures for investment in capital goods or inventories; or by government expenditures.

## HIGHER TAXES, LESS INVESTMENT

The division of total output among consumers, investment, and government will be somewhat different in 1950 and 1960 than in the past. About two-thirds of total output will go into consumer goods and services. This is about the same as the proportion in prewar years.

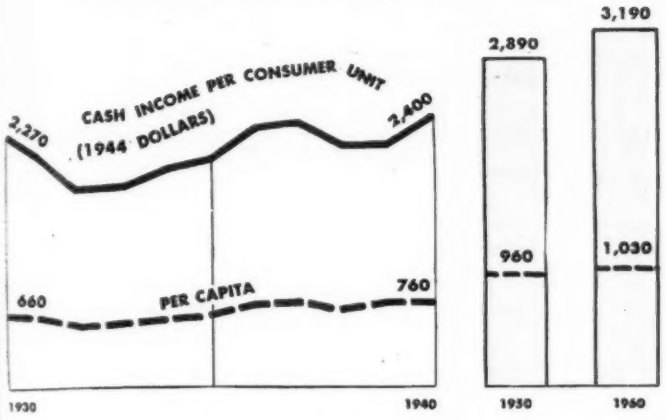
Government's share will continue to grow, however. It rose from 11% of total output in 1929 to 17% in 1940. At the peak of the war effort, half of all production went to Uncle Sam. Government expenditures have dropped to less than half the war peak and they will continue to decline slowly. But government's share will still run to around 20% in the 1950's. On the other hand, the ratio of investment to total output shows a slight long term decline.

HOW TOTAL OUTPUT IS DISTRIBUTED

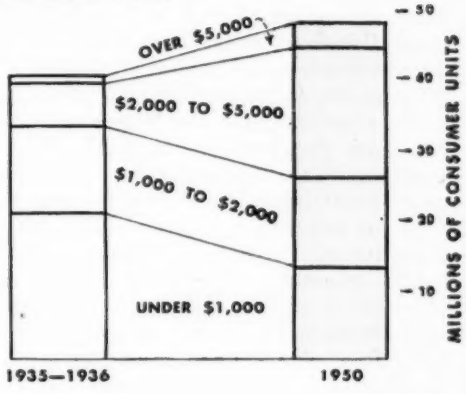


## MORE CONSUMER PURCHASING POWER

CONSUMERS WILL BE ABLE TO BUY 50% MORE THAN IN 1930'S




EVERY OTHER FAMILY... INSTEAD OF EVERY SIXTH FAMILY... WILL HAVE $2,000 OR MORE TO SPEND.




### CONSUMER INCOME

U. S. business can look forward to a 1950 consumer market twice as large as in the worst year of the depression, half again as large as in 1929, and one-fifth larger than in 1941. That is the major conclusion of the 20th Century Fund's analysis of consumer purchasing power. Here are the steps by which it arrives at that conclusion:

1. With gross national product at $177 billion in 1950, past experience indicates that income payments to individuals would run to $138 billion.

2. Income tax rates are assumed to equal the 1942 schedules, so individuals would pay $11 billion in taxes (as against $19 billion in 1946).

3. Savings are estimated at $12 billion, or about 9% of income after taxes.

4. Subtracting taxes and savings, consumer purchases of goods and services would total $116 billion.

### LOWER SAVINGS

Many experts would criticize the assumption that savings will amount to only 9% of income. Some of them look for a ratio as high as 20% in prosperous postwar years. The 20th Century Fund justifies the use of a low figure on three grounds: (1) people built up reserve of savings during the war; (2) expanding social security will reduce the need to save for old age; and (3) taxes will cut into savings. The Fund's estimate of savings plus taxes in 1950 adds up to a higher percentage of income than in prosperous prewar years.

The standard of living won't rise as rapidly as the total income going to consumers, because the increased income will be split up among more family units. But the average consumer unit (a family or a single person living alone) will be a third better off in 1960 than in the 1930's.

Shifts in the distribution of income will be even more important, from a marketing standpoint, than the general increase in over-all consumer income. More consumer units will be in the over-$2000 brackets than ever before and this group will be receiving a much larger share of total consumer income.

Part of the apparent increase in income is cancelled out by higher prices. To show the actual increase in purchasing power, the figures should be adjusted for an estimated one-third increase in the 1950 price level over that of the mid-1930's. This would mean that a $2,650 income in 1950 would buy no more than a $2,000 income in 1935-36. Even if this adjustment is made, the resulting figures still show a striking upward shift.

| Income Class | Consumer Units in Millions | | Cash Income in Billions | |
|---|---|---|---|---|
| | 1935-56 | 1950 | 1935-36 | 1950 |
| Total | 39.2 | 47.9 | $85.0 | $135.0 |
| Under $1000 | 20.8 | 13.0 | 17.0 | 7.7 |
| $1000-2000 | 12.2 | 12.9 | 28.1 | 21.5 |
| $2000-5000 | 5.5 | 18.2 | 23.8 | 62.1 |
| Over $5000 | 0.7 | 3.8 | 16.1 | 43.7 |

**FOR CONSUMERS...**

In addition to dollar income, shown in the above table, consumers also receive "income in kind"—food and fuel produced by farmers for their own use, board and lodging received by domestic servants. Such income will have a value estimated at $3.3 billion in 1950, most of which will supplement the $7.7 billion received by those in the "under $1000" bracket.

The urban market will continue to be far more important than the rural market. Consumer units in cities will receive cash incomes of $3,445 on the average in 1950, more than twice the farm average of $1,635 and almost twice the small town average of $1,880.

### THE FARM MARKET

These figures don't provide an accurate measure of the relative importance of the rural and urban markets because rural consumers pay a lot less for food, fuel, shelter and so have more to spend for other things. If there were any way to adjust for these things, the figures would show a smaller spread between the two markets, but the urban market will still be dominant.

All these figures underline a general upgrading in consumer demands which would accompany high-level production and employment. It will have a profound effect on marketing practices. The average person will eat better, dress better, and live in a better house with better equipment. And he will have more money to spend for travel, recreation, and luxuries.

## CONSUMER MARKETS

The improvement in living standards during the 1950 decade will lead to important changes in the way consumers spend their dollars. Even though they will eat better, dress better, and live in better houses, a smaller share of the consumer dollar will be spent on food, clothing and shelter. A growing share will go for appliances, furniture, travel, and recreation.

This means that the fastest growing markets will be those providing what might be called "optional" goods and services — things which add to comfort and enjoyment but which are not strictly necessary. Markets for necessities, on the other hand, will expand at a slower rate than total consumer expenditures.

The growing importance of "optional" goods and services is one of the reasons why it's increasingly difficult to keep our economic machine going on an even keel. The purchase of "optional" goods can be postponed with little hardship. So anything that causes people to put off buying a new car, a new house, or a new radio has a far greater effect on production and employment now than it did when the major share of the consumer dollar went for necessities.

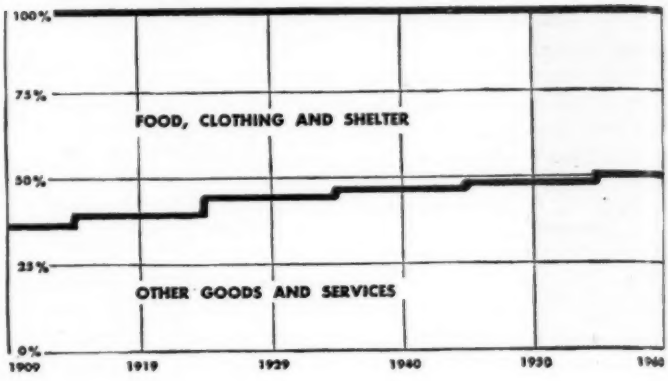
Some of the trends in major markets are summarized in the following sections.

### FOOD

Although food is by far the largest item in the consumer budget, its relative importance is declining slowly as living standards rise. People eat the same number of pounds of food they ate in 1909 but the food is better from a nutritional standpoint and easier to prepare. Thus, the trend favors fruits, vegetables, and dairy products as against meat, potatoes, and bread.

More and more food is being processed in factories rather than in consumer kitchens. Improved methods of manufacture and distribution have transformed the luxury foods of yesterday into the standard foods of today. New kinds of processed foods — canned, frozen, and dehydrated — are appearing constantly.

**STANDARD OF LIVING YARDSTICK: MORE OF THE CONSUMER DOLLAR GOES FOR THE COMFORTS OF MODERN LIFE**




### CLOTHING

Three long term trends will shape the clothing market in the future: (1) the shift from home and custom to factory fabrication is almost complete;

## WHERE CONSUMER DOLLARS GO

(Figures in Billions of Dollars)

| | 1909 | 1919 | 1929 | 1940 | 1941 | (1944 Prices) 1950 | 1960 |
|---|---|---|---|---|---|---|---|
| Total Consumer Expenditures | 28.8 | 60.8 | 80.3 | 70.6 | 80.4 | 116.2 | 134.2 |
| Food, Liquor, and Tobacco | 9.9 | 22.3 | 23.7 | 21.9 | 25.3 | 36.2 | 41.1 |
| Food | 7.4 | 18.8 | 19.9 | 16.4 | 19.0 | 27.2 | 30.8 |
| Liquor and Tobacco | 2.5 | 3.5 | 3.7 | 5.5 | 6.3 | 9.0 | 10.3 |
| Clothing and Personal Care | 4.4 | 9.8 | 12.1 | 9.8 | 11.5 | 16.2 | 18.7 |
| Housing | 6.8 | 10.1 | 14.4 | 12.6 | 13.3 | 19.3 | 21.4 |
| Rent a. | 5.5 | 7.9 | 11.3 | 9.1 | 9.7 | 14.0 | 15.4 |
| Fuel | 1.0 | 1.5 | 1.7 | 1.7 | 1.8 | 2.5 | 2.8 |
| Electricity | 0.1 | 0.3 | 0.6 | 0.9 | 1.0 | 1.6 | 1.8 |
| Household Equipment and Operation | 2.8 | 6.2 | 10.6 | 8.7 | 10.3 | 15.0 | 17.4 |
| Appliances | 0.2 | 0.4 | 0.8 | 1.0 | 1.3 | 1.8 | 2.4 |
| Consumer Transportation | 1.6 | 5.2 | 8.6 | 7.3 | 8.6 | 12.7 | 16.4 |
| Autos and Private Planes b. | 0.6 | 3.5 | 6.0 | 5.7 | 6.8 | 9.6 | 12.7 |
| Local Bus and Street Car | — | — | 0.8 | 0.7 | 0.8 | 1.5 | 1.5 |
| Intercity Bus | — | — | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |
| Airlines | — | — | c. | c. | c. | 0.1 | 0.5 |
| Railroads | 0.4 | 0.8 | 0.6 | 0.3 | 0.3 | 0.4 | 0.3 |
| Medical Care, Insurance, and Death Expenses | 1.1 | 2.8 | 4.5 | 4.7 | 5.2 | 7.7 | 8.7 |
| Recreation | 0.9 | 2.1 | 3.8 | 3.3 | 3.7 | 5.7 | 6.9 |
| Radio and Television Sets | 0.2 | 0.7 | 1.0 | 0.6 | 0.8 | 1.1 | 1.3 |
| Private Education, Religion, and Welfare | 1.2 | 2.2 | 2.7 | 2.3 | 2.4 | 3.4 | 3.7 |

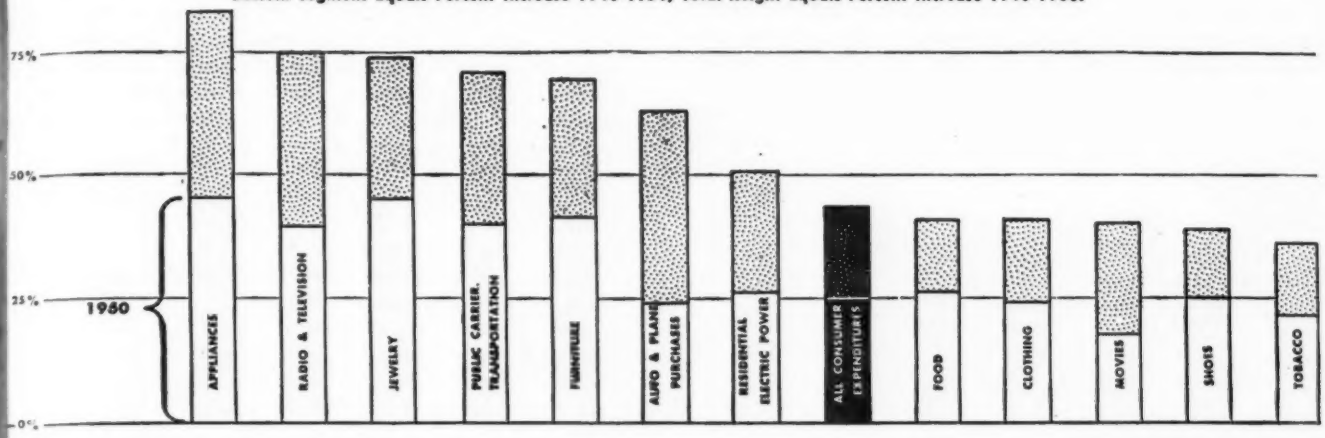
a. Includes Estimated Rent for Owner-Occupied Homes.

b. Includes Original Cost and Operating Expenses.

c. Less than $50 Million.

CONSUMER MARKETS IN 1950 AND 1960: Percent Increase in Sales Over 1940

Bottom Segment Equals Percent Increase 1940-1950; Total Height Equals Percent Increase 1940-1960.




(2) synthetics, chiefly rayon and nylon so far, are replacing cotton, wool, and silk at an accelerating pace; (3) there's greater standardization of styles and a trend to lighter and simpler clothing.

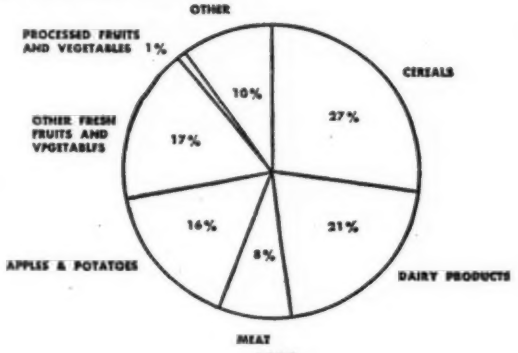
In 1909 consumers spent 14% of their income for clothing but by 1940 the ratio had reclined to 12%. However, this long run decline may be halted or reversed. The migration from farms to cities, the upgrading of incomes, and the growing demand for sports clothing will increase clothing expenditures.

## HOUSING

The decline in the relative importance of housing expenditures — from 24% of consumer dollars in 1909 to less than 18% in 1940 — is expected to continue. The reason is that people feel they get more value for their dollars in other things than housing. Nevertheless, the housing market should be much larger in the 1950's than in the 1930's because much of our housing needs to be repaired or replaced.

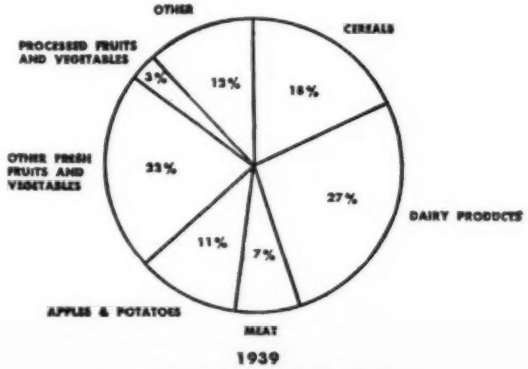
A Census survey in 1940 showed that 16 million of the nation's 37 million dwelling units needed to be replaced or needed major repairs. The 20th Century Fund estimates that the provision of adequate housing for everyone by 1960 would involve building 20 million new units and rehabilitating 5.4 million at a total cost of $115 billion (1944 prices). The Fund also estimates that we will fall 15% short of this goal even with continued high-level employment.

OUR CHANGING DIET: MORE MILK, FRUITS AND VEGETABLES LESS MEAT, POTATOES AND BREAD




1909

1880 POUNDS OF FOOD PER PERSON




1939

1882 POUNDS OF FOOD PER PERSON

## HOUSEHOLD EQUIPMENT

More and more of the consumer dollar has gone for household equipment in the past four decades, largely because of the development of labor-saving appliances. The outlook is for a continuation of this trend. New appliances are being developed; and the large number of new houses slated to be built in the next few years, the wartime and postwar boom in the number of families, and the migration to the cities should add to appliance demand. The same factors should brighten the outlook for furniture, rugs, and other household items.

Some appliance markets may be saturated by the 1950's, however. A few years of high production would fill our homes with refrigerators, for example. However, replacement demand would run to 2.7 million units in 1960 and there would be a demand for 1.3 million refrigerators to equip new houses, so the market would still be bigger than in 1941 when 3.6 million were sold. However, new products must be developed if the industry is to keep up the pace it has set in the past.

## TRAVEL

In 1916 the average person traveled 400 miles. By 1940 the average had grown to 2,400 miles, chiefly because of the rise of the automobile. The 20th Century Fund expects this growth to continue because as their incomes rise people spend more money traveling.

A good share of the increased spending will go to purchases of cars and planes. The Fund estimates that there will be 36 million cars on the road and 100,000 private planes in the air in 1950. The auto industry would be able to sell 5 million new cars a year after 1950 — 4 million for replacement and a million for population growth.

## CAPITAL INVESTMENT

Investment plays a crucial role in our economy for two reasons. It is by plowing back part of our annual output that we are able to provide better machines and equipment to keep productivity rising. But the amount ploughed back varies widely from year to year. This unevenness of capital investment contributes to the instability of production and employment.

Because capital investment involves the purchase of durable goods, it can be postponed almost indefinitely when the outlook for profits darkens. Thus, capital investment plummeted from $18 billion in 1929 to $5 billion in 1933, a drop of 72%, whereas consumer spending fell only about half as fast in the same period.

## MORE FOR EQUIPMENT

There has been an important shift in the relationship between construction and equipment, the two major types of investment. Before World War I, construction made up around three-fourths of total investment but the ratio declined to less than half in 1935-39. Part of the decline is, of course, explained by the fact that the depression left us with ample plant capacity but provided an incentive to buy more efficient machines to cut costs. Nevertheless, there is a well-defined trend towards allocating an increasing proportion of investment to equipment rather than to plant construction.

**CAPITAL INVESTMENT . . .**

A little less than two-thirds of total investment goes into industrial plants and equipment. Housing and other consumer construction (hospitals, schools, churches) averaged 27% of total investment during the interwar period. Housing fell from a peak of $6 billion in 1926 to $4.7 billion in 1929 and $600 million in 1933; and it had recovered only half the 1926 volume by 1940.

While other types of investment follow the ups and downs in general business, investment in housing construction follows a cycle of its own. This housing cycle is determined by factors such as the vacancy rate, the level of rents, and that of construction costs, which may not follow the trend of general business. When a drop in general business activity takes place during a declining phase of the housing cycle, as it did in 1929, the result is a deep and prolonged depression.

Government investment, of which the largest component is highways, has been much more stable than other types but it doesn't swing enough weight to stabilize total investment.

Because of the wide fluctuations in capital investment, it's much more difficult to estimate future capital expenditures than future consumer purchases. In order to make a relatively stable forecast, the 20th Century Fund bases its estimates on the long term trend since 1879, which shows a slight decline in the share of total output going to capital investment. Thus, investment under conditions of stable prosperity in the 1950 decade is estimated at 16% of total output as compared with a ratio of more than 18% in the late 1920's. On this basis, estimated capital expenditures work out to $28 billion for 1950 and $33 billion in 1960. Our ability to maintain high employment and rising living standards will depend in large measure on our ability to invest that much profitably in new machinery and buildings.

## CAPITAL NEEDS

Analysis of our capital needs lends little support to the idea prevalent during the 1930's that we had reached economic maturity so that there was no way to invest as much as we had in earlier decades. No one has ever made an estimate of how much it would cost to modernize our industrial plant, which is valued at around $200 billion at prewar prices. If as much as a third of it needs to be replaced or rehabilitated, around $100 billion (current prices) of additional investment will be required.

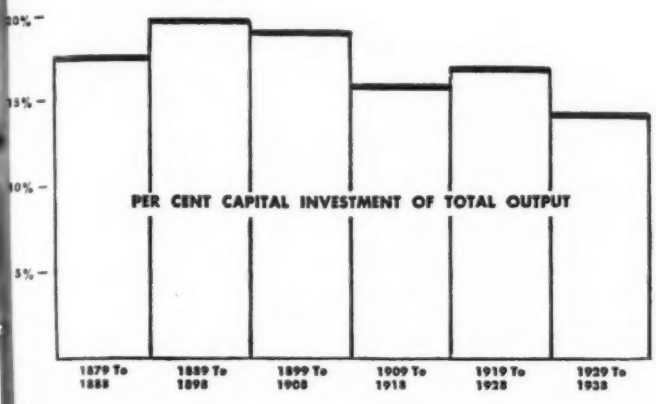
In addition, huge amounts of money need to be invested in housing and public works to raise the serv-

## WHERE INVESTMENT DOLLARS GO

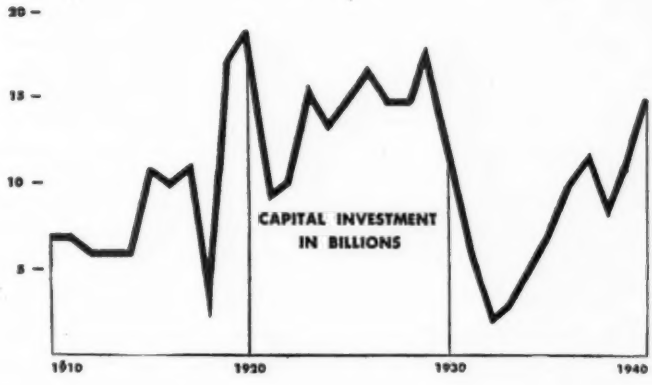
(Figures in Billions of Dollars)

| | (Annual Averages) | | | | | (1944 Prices) | |
|---|---|---|---|---|---|---|---|
| | 1920-1924 | 1925-1929 | 1930-1934 | 1935-1939 | 1940-1944 | 1950 | 1960 |
| Total Capital Investment | $12,428 | $17,186 | $8,215 | $10,445 | $12.340 | $27,700 | $33,000 |
| All Industries | 7,570 | 10,112 | 5,272 | 6,889 | 8,089 | 17,800 | 21,125 |
| Manufacturing | 1,996 | 2,362 | 1,074 | 1,610 | 3,731 | 4,200 | 5,025 |
| Food | 261 | 357 | 194 | 244 | | 228 | 273 |
| Textiles | 227 | 212 | 92 | 117 | | 175 | 210 |
| Steel | 138 | 188 | 110 | 192 | | 853 | 1,021 |
| Autos | 105 | 150 | 78 | 146 | | 369 | 441 |
| Chemicals & Petroleum | 70 | 95 | 68 | 142 | | 928 | 1,111 |
| Machinery | — | — | — | 28 | | 180 | 216 |
| Other | 510 | 625 | 213 | 409 | | 1,462 | 1,750 |
| Transportation | 1,797 | 2,303 | 1,277 | 1,822 | 805 | 4,300 | 5,100 |
| Commercial | 1,196 | 1,940 | 777 | 719 | 833 | 1,950 | 2,300 |
| Utility | 693 | 999 | 483 | 422 | 780 | 1,500 | 1,625 |
| Other | 1,888 | 2,508 | 1,661 | 2,316 | 1,940 | 3,950 | 4,700 |
| Consumer Construction | 3,806 | 5,557 | 1,547 | 2,256 | 2,912 | 7,200 | 8,255 |
| Government Construction | 1,052 | 1,517 | 1,396 | 1,299 | 1,338 | 2,700 | 3,620 |

OVER THE YEARS ABOUT 1/5 OF TOTAL OUTPUT IS PLOWED BACK AS INVESTMENT




BUT THE AMOUNT PLOUGHED BACK VARIES GREATLY FROM GOOD YEARS TO BAD, ACCENTUATING THE SWINGS OF THE BUSINESS CYCLE




ices provided merely to adequate levels. The 20th Century Fund estimates that the cost of a 15 year program to modernize our city streets and rural highways would run to $40 billion. To bring the nation's housing up to minimum standards of health and decency by 1960 would cost $115 billion. To conserve our natural resources and develop our water power would cost $27 billion over a 15 year period.

There seems to be little question that needs exist for all the capital investment we can make for a long time to come. The behavior of investment in the past strongly suggests that the problem is not one of lack of needs but one of finding ways to add to our capital in an orderly fashion. Capital investment has followed the boom and bust route in the past; what is wanted is a high but steady rate of investment.

## WARTIME INVESTMENT DEFICIT

Demand for capital goods is stronger right now than ever before, largely because of the backed-up needs arising out of the war. Here is how wartime expenditures for capital goods which can be used in peacetime production compared with expenditures in the last 5 years of both the 1920's and 1930's: (Figures in billions of dollars)

| | 1925-1929 | 1935-1939* | 1940-1944 |
|---|---|---|---|
| Total Capital investment | $86 | $65 | $49 |
| Industrial | 51 | 43 | 32 |
| Manufacturing | 12 | 10 | 14 |
| Metals, chemicals, machinery, petroleum | 6 | 6 | 11 |
| All Other | 6 | 4 | 3 |
| Commercial | 10 | 5 | 3 |
| Railroads | 5 | 3 | 3 |
| Electric power | 5 | 3 | 3 |
| Consumer Construction | 28 | 14 | 12 |
| Public Works | 7 | 8 | 5 |

* Adjusted to Wartime Prices

Wartime restrictions held investment in all civilian lines far below what would be spent in prosperous peacetime years. Thus, there was a backlog of investment needs at the end of the war which ran to more than $30 billion, if the 1925-1929 demand can be taken as typical. Whatever the precise size of the backlog, it is clearly great enough, when added to the normal yearly demand for new investment, to keep the heavy goods boom going for some time to come. The test of our ability to stabilize capital investment will come later.

There is also a huge foreign demand for American capital. How far we will go toward meeting this depends largely on whether international political and economic conditions are stable enough to make private foreign investment a good risk.

If we invest abroad in the same proportion we did in the late-1920's, our foreign investments will total $1.6 billion during the year 1950 and $1.5 billion in the year 1960. This will mean a net increase in our foreign holdings of $15 billion during the 1950's, raising the total of such holdings to about $25 billion, as against a total of $10.6 billion in 1940.

To make that much foreign investment pay out, an expanding volume of world trade would be required. Foreign nations would have to get enough dollars not only to pay for goods they bought from us but also to pay interest and dividends on U. S. investments. If our overseas investments increase to $25 billion by 1960, annual interest and dividends owed us will run to almost $1¾ billion.

To pay us that much, foreign nations would have to sell much more in the U. S. than ever before. The 20th Century Fund calculates that imports of $7.3 billion in 1950 and $8.1 billion in 1960 would provide other countries with the dollars they need. Imports ran to $2.5 billion in 1940 so we would have to buy 3 times as much abroad to keep expanding our foreign investments.

With good business, U. S. demand for imported goods should be well above prewar. Rising living standards will widen the market for such consumer items as British tweeds and French perfumes. Moreover, we will need to import more raw materials than ever before because we used up our natural resources at a prodigious pace during the war.

## NEW INDUSTRIES

The new methods, materials, and products developed during the war may well have a more profound and lasting effect on future capital requirements than the backed-up demands accumulated in wartime. Here are some of the wartime developments which may have important peacetime applications: new chemical processes and products including synthetic rubber, plastics, synthetic fibers and fabrics; new food products and new methods of food processing; new uses for glass, plywood, and the light metals; tremendous advances in aviation; and new applications of atomic energy and fissionable products in power production and medicine.

Large capital expenditures will be required to push these developments further and adapt them to civilian use. New businesses and perhaps entire new industries will grow up, adding to the demand for capital goods for many years.

## THE COST OF GOVERNMENT

To the traditional certainty of death and taxes can be added the certainty that the cost of government will take a much larger share of national income than ever before in peacetime. After the Civil War and again after World War I, federal expenditures moved up to a level four times prewar. And it is already clear that World War II is going to have about the same effect.

In 1940, federal, state, and local governments spent $19 billion, of which a total of $2.2 billion went for national defense, veterans, and interest on the war debt. By 1950, the 20th Century Fund estimates that all governmental units in the U. S. will be spending more than $45 billion. Federal expenditures are estimated at $27.6 billion in that year as against $9 billion in 1940.

Part of the increase is explained by higher postwar prices. Adjusting for price changes would reduce the 1950 figure from $45 billion to $33.5 billion. This is still 80% above the 1940 level. Increased expenditures for public works, social insurance, and schools explain another small part of the rise.

But costs arising out of the war are by far the most important factor. Military and veterans' expenditures and interest on the war-swollen national debt will add up to over $17 billion in 1950. This is only 10% less than total government expenditures in 1940.

The only major category of government expense which would be lower in 1950 is welfare. With high-level employment and more social insurance, relief and other welfare costs should run to $2.5 billion in 1950 as against $3 billion in 1941.

The following paragraphs describe important trends in the major items of government expense.

### MILITARY

The 20th Century Fund assumes that we will maintain an armed strength of 2 million men (including trainees) and that it will cost $3,300 to equip and maintain each man, so total military expenditures will run to $6.6 billion. But even if we decide to maintain a smaller armed strength, the total cost might easily be at least $6.6 billion because the present per serviceman cost of over $6,000 a year may not decline.

***AND GOVERNMENT . . .***

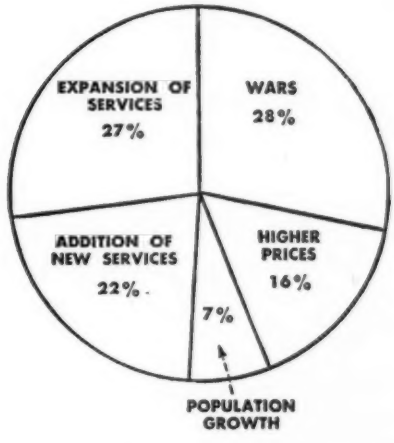
### VETERANS

It will cost at least $2.9 billion to take care of veterans in 1950 even if benefits are not increased. That's 5 times the 1941 cost. Pensions for World War I veterans rose steadily from $116 million in 1924 to over $300 million in 1945. That rise will continue for another 20 years. By far the largest expense will be for World War II pensions which are already costing $900 million. Disability and death benefits will cost about $1¾ billion in 1950; hospitalization will add another $250 million; and insurance $150 million.

### SOCIAL SECURITY

Future expenditures for social security will depend on whether steps are taken to extend coverage and liberalize benefits. Over 60 million people are now covered so the cost is certain to increase rapidly as more of them begin to draw payments. With high-level employment in 1950, estimated old age and unemployment benefits under the present system would run to over $5 billion. Expansion of benefits, as recommended by the Social Security Board, would raise the cost to over $9 billion.

**WHY THE COST OF GOVERNMENT HAS INCREASED. The $25.6 billion increase in cost from 1913 to 1941 was due to:**




### PUBLIC WORKS

Even an economy-minded Congress is almost certain to go along with expenditures for highways, airports, waterways, flood control and conservation. Thus an increase in expenditures for transportation and natural resources from less than $2.5 billion to over $5 billion in 1950 seems probable.

### SCHOOLS

Education ranks third among all government expenditures. In 1941 we spent almost $2.5 billion—10% of all government dollars—on schools. Teachers' salaries account for almost three-quarters of the total cost so the trend towards higher salaries will boost the nation's bill for education.

## WHERE TAX DOLLARS GO

(Figures in Billions of Dollars)

| | 1913 | 1932 | 1941 | (1944 Prices) 1950 | 1960 |
|---|---|---|---|---|---|
| All Government Expenditures | 2.5 | 12.4 | 23.1 | 45.5 | 50.7 |
| Federal | 0.7 | 4.3 | 12.9 | 27.6 | 28.6 |
| State | 0.2 | 1.8 | 3.6 | 7.0 | 9.3 |
| Local | 1.6 | 6.3 | 6.6 | 10.9 | 12.8 |
| Military | 0.27 | 0.7 | 6.1 | 5.6 | 6.6 |
| Veterans | 0.18 | 0.8 | 0.6 | 2.9 | 3.2 |
| Interest | 0.15 | 1.3 | 1.7 | 7.9 | 8.1 |
| Social Insurance | — | 0.2 | 1.9 | 7.7 | 8.7 |
| Welfare & Health | 0.31 | 1.5 | 4.1 | 4.0 | 4.1 |
| Education | 0.65 | 2.5 | 2.7 | 3.7 | 4.3 |
| Public Works | a. | a. | a. | 5.6 | 7.1 |
| Transportation | 0.40 | 1.9 | 2.0 | 1.8 | 2.7 |
| Natural Resources | 0.03 | 0.6 | 1.4 | 1.2 | 1.1 |
| Police & Fire | 0.19 | 0.7 | 0.7 | 1.0 | 1.1 |
| Other | 0.40 | 2.4 | 2.0 | 3.0 | 3.6 |

a. Included in other groups.

## NATURAL RESOURCES

The war left the U. S. with a depleted supply of most natural resources, and with critical shortages of some of the most essential minerals. Nevertheless, lack of natural resources should not be a limiting factor on our productive capacity. With relatively free access to world markets, we should be able to get all the raw materials we need. And, even if we were denied access to world markets, we could use our low-grade reserves and develop substitutes without causing a prohibitive reduction in our living standards, though everyone would feel the effects in one way or another.

The U. S. economy consumes about a billion and a half tons of raw materials each year, or about 11.5 tons per person. Of this 3.5 tons are coal, 1.5 tons are petroleum, and iron and copper ore each contribute about a half a ton. In 1939 the value of unrefined minerals output was $4.2 billion and 2% of all workers were engaged in mining or lumbering.

## FUTURE REQUIREMENTS

The level of industrial production projected by the 20th Century Fund would raise minerals requirements a third above 1940 by the year 1950 and 50% above 1940 a decade later. Here is how natural resources requirements in the 1950 decade would compare with 1940 and the wartime peak: (Index numbers, 1940 equals 100)

| | *Wartime Peak* | *1950* | *1960* |
|---|---|---|---|
| All minerals | 138 | 133 | 151 |
| Metals | 157 | 117 | 126 |
| Fuels | 130 | 141 | 164 |
| Other | 141 | 128 | 142 |
| Lumber | 126 | 93 | 76 |
| Electric Power | 159 | 173 | 224 |
| Manufactured Gas | 120 | 94 | 75 |

The capacity of our supplies of natural resources to support future levels of output cannot be determined with any great accuracy. It will depend on the size of our reserves and on our ability to use supplies more economically and develop substitutes.

***WITH THE RESOURCES AVAILABLE . . .***

Because there is no way to measure these factors with any degree of precision, all estimates of the number of year's supply are subject to wide errors. However, such estimates are useful in directing attention at those resources where every effort should be exerted to develop new supplies, substitutes, and more economical methods of use.

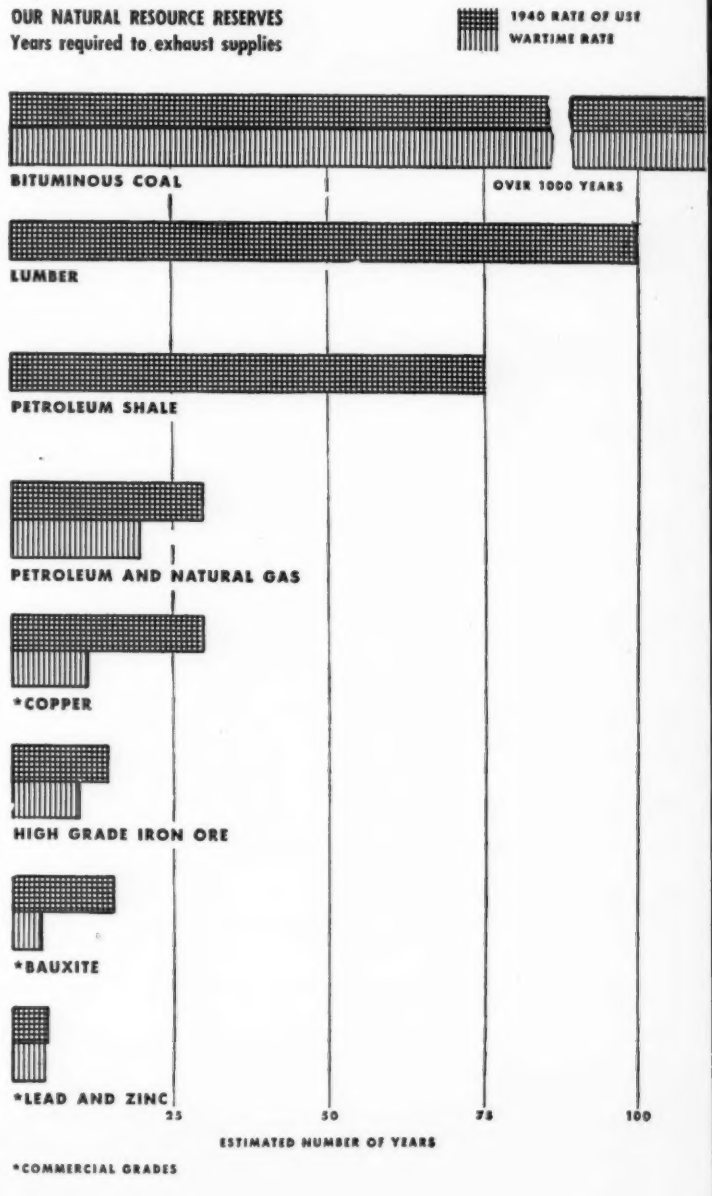
## BIGGEST PROBLEMS: LEAD AND ZINC

Commercial grades of zinc, lead, and bauxite will be exhausted before 1960 even if the rate of use is cut to half the wartime rate. Supplies of petroleum and natural gas — which furnish 40% of our energy — will last longer than 20 years but their partial depletion will raise many technical and economic problems long before that time. Possible exhaustion of high-grade deposits of such minerals as iron and copper in the foreseeable future will stimulate development of processes to use low-grade deposits.

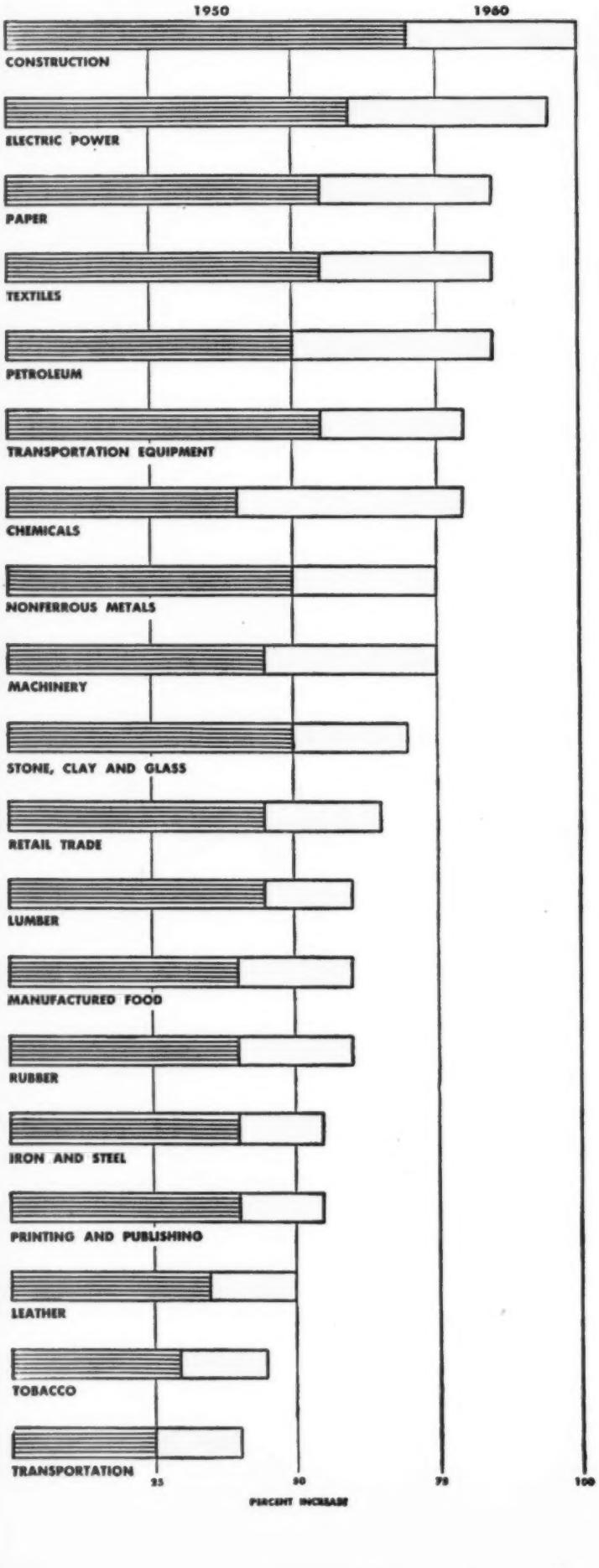
We have been discovering more and more ways to stretch our supplies of natural resources, however. In the case of tin, the electroplating process saves 50% of the tin used in tinplate production. The electric power industry uses less than 40% as much coal per kwh now as in 1920. The development of new materials and new ways of using old materials also expands our resource capacity.

Our bituminous coal reserves are adequate for over a thousand years even at the wartime rate of use, though production costs might rise substantially as inferior coal beds were used. After that, there are huge deposits of sub-bituminous coal and lignite which could carry us along for another thousand years. In comparison, maximum petroleum reserves are minute, adequate only for about 30 years consumption at the current rate. That is why the experts are trying to find ways to produce oil from coal cheaply enough to be commercially feasible.

Even though we have been using up lumber faster than it grows, there is little doubt that enough will be available in the future to meet at least minimum needs. Annual timber growth runs to about 32 billion board feet. But we cut over 40 billion board feet a year before the war and lost another 6 billion through fire, insects, and disease. An adequate conservation program could increase annual growth enough to offset this depletion.



**PRODUCTION PROSPECTS: Estimated Percentage Increase in Industrial Activity Over 1940**




## INDUSTRIAL CAPACITY

At the end of World War II U. S. industry found itself with surplus capacity in some lines and serious deficiencies in others. There was more than enough aircraft, machine tool, and synthetic rubber capacity but not nearly enough sheet steel, copper, or electrical machinery capacity to meet pent-up demands.

War experience showed, however, that industrial capacity can be expanded enormously in a few years, given the need and the funds. Thus lack of industrial capacity should not prove a bottleneck to meeting the demands of consumers in the 1950 decade.

A rough estimate places our total investment in industrial facilities (manufacturing, mining, transportation, and distribution) at $200 billion. Just how much capacity industry as a whole, or any given industry, has is impossible to measure.

Capacity is a most elusive concept. In a technical sense, the capacity of an industry is the combined production of all its plants working 24 hours a day, 365 days a year, less an allowance for repairs, breakdowns, and other technical factors. Actual capacity is far less, however. Some facilities are obsolete or high-cost. Supplies of raw materials and components may be insufficient to keep assembly plants running full-steam. Moreover, demand for many products isn't great enough to support round-the-clock production.

## PLENTY OF CAPACITY

During the past quarter century, however, experience shows that we have had more than enough overall capacity, and more than enough capacity in almost every industry, to meet all demands. An extensive study showed that even in 1929 only the steel and machine tool industries were definitely operating at capacity.

The growth of productivity as old machines are replaced with new and more efficient ones and as new techniques are developed is one of the main reasons why industrial capacity more than keeps pace with markets. The depression of the 1930's led to a net retirement of about 5% of total manufacturing facilities but manufacturing plants in 1939 could have turned out a quarter more than in 1929 because productivity was a third higher.

Whenever an industry's output begins to approach technical capacity, it becomes profitable to purchase new and more efficient equipment to replace or supplement existing machines so that a certain amount of excess capacity seems to be inevitable in a free enterprise system.

Estimates of the level of industrial production in different lines under conditions of high-level employment during the 1950 decade are shown in the chart. They assume that past trends will continue so that they give only a rough idea of what would happen to output in each industry. Unpredictable shifts of consumer demand or new product developments might cause a big change in the pattern of industrial production. Such estimates are, nevertheless, useful in that they provide a clue to lines where the largest increases may take place.

None of the projected increases are so large as to tax our ability to provide enough capacity. This is not to say that there will be no bottlenecks because of lack of capacity for certain components, for instance. However, we should be able to make good in short order any deficiencies of that sort that may develop.

## DEMANDS VERSUS NEEDS

Despite the substantial increase in living standards which would be possible with high-level production and employment in the 1950 decade, many U. S. consumers will be unable to buy enough of life's necessities to maintain themselves at a health and decency level. Almost 30% of all families would receive less than $1,000 a year cash income and one-third of this group would receive less than $500.

The 20th Century Fund asked a series of experts to estimate the quantities of food, clothing, housing, medical care, and other things needed to provide a standard of living at a minimum health and decency level. The experts also figured out how much it would cost to bring everyone expected to be below that standard in 1950 and 1960 up to the calculated level. In other words, the estimates show the cost of establishing a "floor" for consumption without disturbing the spending patterns of those who received more than enough income to satisfy the calculated minimum needs.

## ESTIMATES OF NEEDS

Any estimate of "needs" must rest upon someone's opinion as to what constitutes "health and decency" in this day and age. In the case of food, the nutritional requirements of a minimum health and decency standard can be determined accurately. In other fields, such as housing and education, even the experts would disagree over what constitutes a minimum standard.

However, what is important is not the precise size of the estimates but their general magnitudes. The conclusion that we would have to spend about 50% more on medical care than we are likely to in 1950 is important even if the experts' appraisals of the deficit range from as high as 60% to as low as 40%.

To fill total needs calculated in this manner would require production of $200 billion of goods and services in 1950 or 13% more than the $177 billion which would be turned out with high-level production and employment. In 1960, estimated production would fall short of needs by 8%. Food accounts for the biggest share of the deficit but needs outrun demand by important margins in housing, medical care, education, and social security.

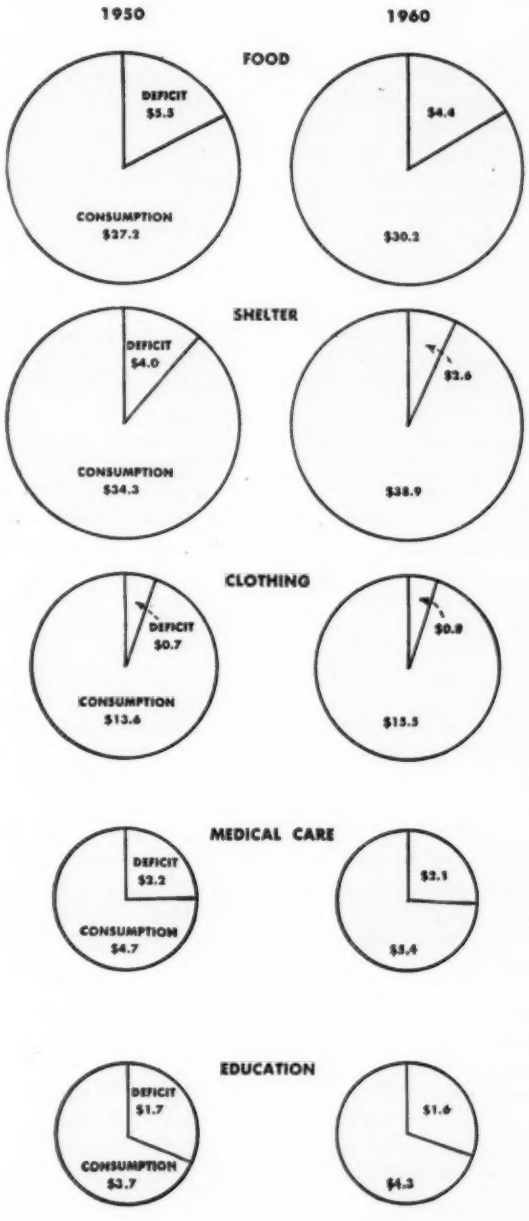
***TO MEET ALMOST ALL OUR NEEDS***

To provide nutritionally adequate moderate-cost meals for those unable to afford them would add $5.5 billion to the $27.2 billion that would actually be spent on food in 1950. This assumes no change in diets of those with adequate incomes despite the fact that many people in those groups do not eat what they should. If we all ate what we needed, we would consume twice as many fresh vegetables as in 1940, half again as much milk, more fruits and tomatoes; and we would eat smaller quantities of sugar, sirups, fats, and oils. This better diet would cost us less than we will actually spend for food in 1950.

So large a portion of our existing housing is unsatisfactory by any reasonable standards that it would take 10-15 years to provide everyone with adequate housing. One of the reasons why we don't have adequate housing is that many consumers cannot afford to pay enough rent to finance it. Estimated expenditures in 1950 for rent (including the estimated rental value of owner-occupied homes) would run to $14 billion as against an estimated need of $16.4 billion.

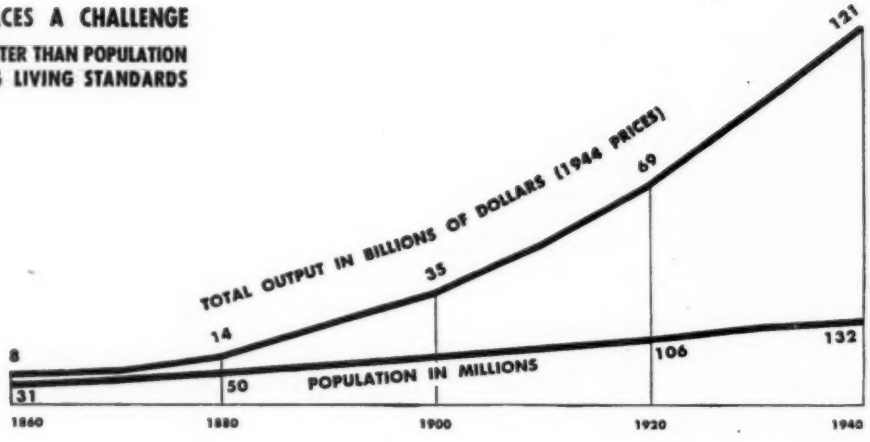
Vast advances in medicine have gone far toward eliminating many diseases and have brought about a steady improvement in the standard of health. However, large numbers of people in the lower income groups cannot afford adequate medical care. Moreover, to supply good medical care for everyone under the traditional fee-for-service basis would cost several times more than consumers have ever spent for medical services even in prosperous years. Development of an effective form of group medicine, however, would make it possible to provide adequate care at a great saving over present costs, according to the 20th Century Fund.

**HOW CONSUMPTION WOULD COMPARE WITH TOTAL NEEDS**
(Figures in billions of dollars)



## THE U. S. ECONOMY FACES A CHALLENGE

**PRODUCTION HAS GROWN FASTER THAN POPULATION GIVING PROMISE OF RISING LIVING STANDARDS**




The major conclusion of the 20th Century Fund's survey of America's needs and resources is that we have reached a point where we can provide everyone with a decent living and most people with a living which, by any standards other than our own, is positively luxurious. With high-level employment, it would take only a 13% increase in total output in 1950, and an 8% increase in 1960, to lift everyone to a minimum health and decency standard of living.

We have more than enough industrial and agricultural capacity to support that much of an increase in total production. Lack of natural resources should not be a bottleneck, for with world trade on any sort of a reasonable basis we will be able to get all the raw materials we need.

The only limiting factor is the capacity of our labor force to produce. The 20th Century Fund assumes that productivity will advance at the average rate actually achieved during the past 9 decades (18%). But there is no technical reason why we cannot achieve an increase of more than 30%. That would make possible enough production to meet our minimum needs.

The U. S. economy has exhibited two dominant characteristics in the past century. Our productive capacity has expanded at a rate never approached elsewhere. But our economy has also been highly unstable. Our problem is to make the most of our unparalleled technological and productive know-how while minimizing the swings of the business cycle.

If we can meet that challenge, we can eliminate the specter of want and move on toward constantly rising living standards for everyone. Never before in history has a nation been so close to abolishing poverty and meeting the material demands of its citizens.

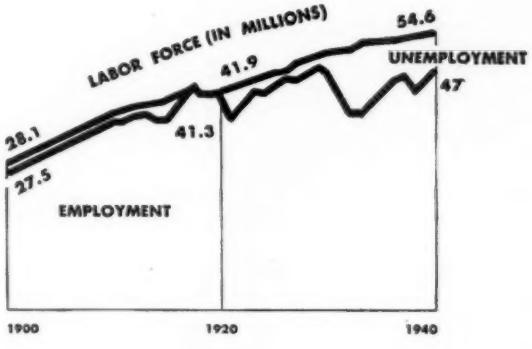
This is not to say that solving the problem of maintaining stable and expanding production would solve all our economic, social, and political problems. Nor is it to say that a solution of the problem of keeping our economic machine running on an even keel is at hand.

In the first place, the U. S. would not be a utopia even if we achieved the kind of high employment and production the 20th Century Fund is talking about. Many perplexing problems of how to best distribute our production would remain. Then there are a host of social and political problems which would still tax our efforts and ingenuity. Finally, there is the all-important question of how to maintain world peace.

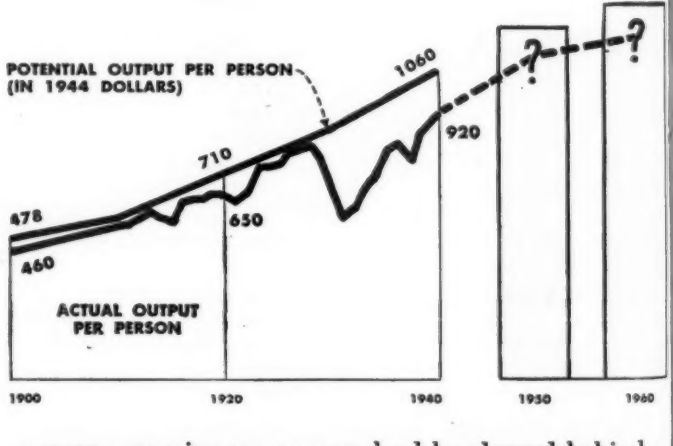
Most people would agree that the problem of maintaining high employment and rising living standards is still far from solution. Our ability to mobilize and direct our economic resources so as to keep our economy running on an even keel has lagged behind our ability to solve technical production problems. Each businessman, each worker, and each consumer must somehow learn to act differently in many ways than he has in the past if we are to solve our number one economic problem.

Just what changes in our economic life will be necessary no one knows. On our ability to find out these things and put them into practice in the next few years depends our success in meeting the challenge which the 20th Century Fund's study underlines. That challenge is that we have within our grasp the ability to eliminate actual want from the U. S. and to provide more and more things for better living for everyone.

**BUT THE GROWTH HAS FOLLOWED THE BOOM AND BUST ROUTE INVOLVING LONG PERIODS OF MASS UNEMPLOYMENT**



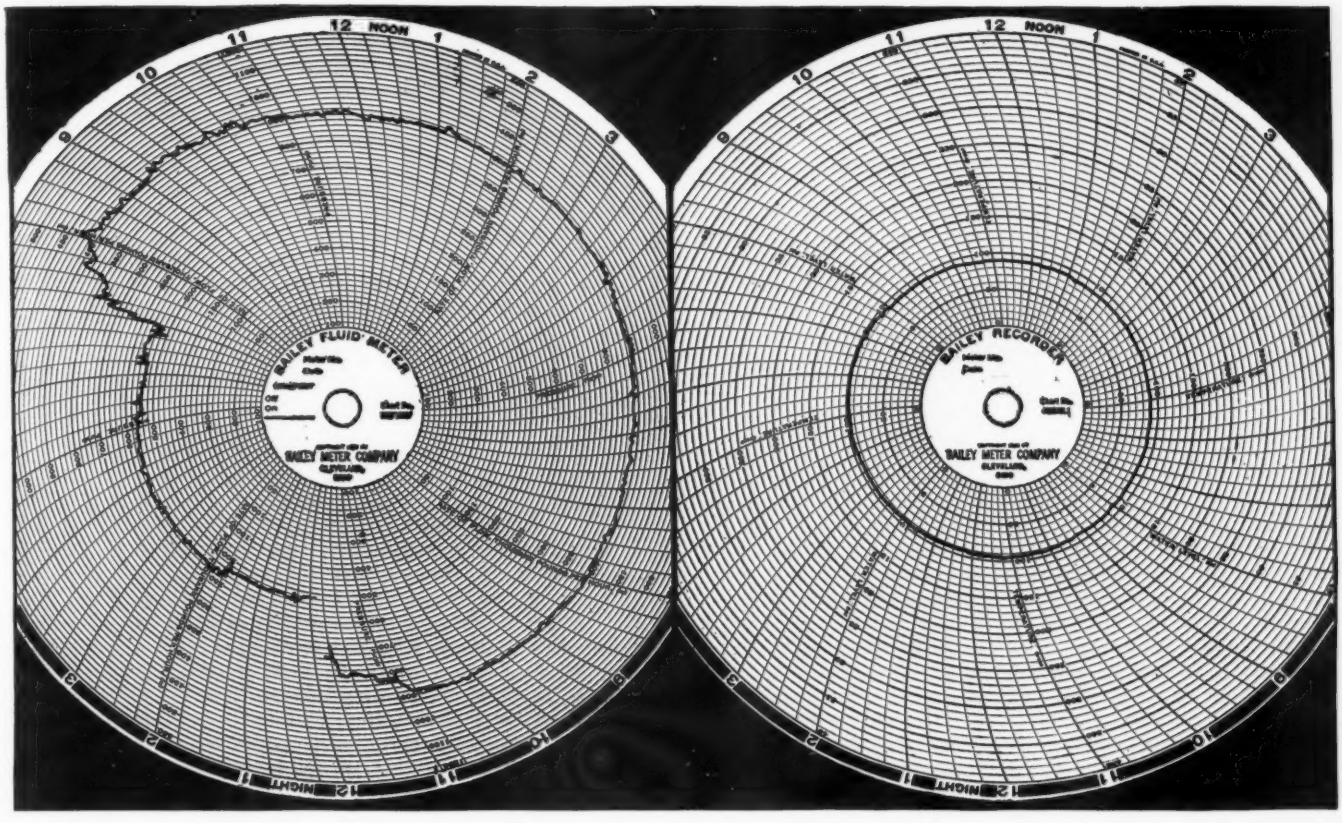

**CAN THE ECONOMY PROVIDE STEADY EMPLOYMENT AND RISING LIVING STANDARDS?**




Reprints of this report are available at a charge of 25¢ each to cover the cost of handling and mailing. Address orders to Department of Economics, McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York 18, N. Y.

# SOUTHERN STATION REPORTS

## level held within plus-or-minus ½-inch




YOU couldn't ask for much closer water level control than is indicated by these charts from a well-known Southern utility station. With a load range of from 200,000 to 430,000 pounds of steam per hour, extreme limits of drum-level variation are no more than plus-or-minus one-half inch.

The steam generator is one of two Combustion Engineering three-drum units in this station. Each has a rated capacity of 425,000 pounds of steam an hour, delivered from the superheater outlet at 860 psi and 835 degrees F. Equally close water level control is obtained on both high-duty units, which are equipped with two-element COPES Flowmatics.

The complete story is told in Bulletin 469, a 16-page performance report on COPES Flowmatic in this and two other stations of the same utility system. Illustrated with plant photographs, sectional views of the boilers and charts, this informative report is yours for the asking. Write for it.

NORTHERN EQUIPMENT COMPANY

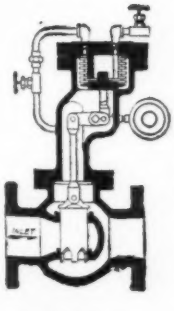
671 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France

*Representatives Everywhere*

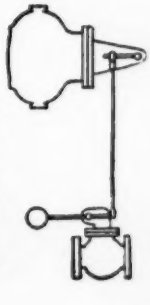
★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC



### DIFFERENTIAL VALVES

COPES Differential Valves maintain constant pressure drop across the feed water regulator valves, regardless of changes in pump pressure or line friction losses accompanying wide fluctuations in boiler load. Individually designed for each installation. Available in separate bodies, as illustrated, or in combination with the feed water regulator valve bodies.

### LIQUID LEVEL CONTROL



For control of water or steam input or output, open or closed vessels. For throttling steam supply to fluid pumps. Semi-steel, cast-steel or forged-steel float chambers, with floats of different sizes and materials to meet individual needs. The direct- or relay-operated COPES Valves have low friction, high lift, accurate balance, ports designed for each installation.

# HOW TO PREVENT CONFUSION

I GUESS IT'S a pretty complex world, this modern globe of ours—at least, that's the idea you get when you learn that certain businesses now have what is called "confusion control."

The originators of this term are the commercial research outfits—they're the people who find out what kind of breakfast food you eat and why you prefer straight ties to the type that Sinatra wears. Some of this group proceed on the theory that many persons can't be trusted, and that with any chance at all, they will "exaggerate" most enthusiastically.

So, these research experts set traps (like asking what you think of a product that has never been manufactured) and the results of the study are discounted in proportion to the number who fall for the fake question. The survey is then sold to the client as being entirely free from confusion. No matter how you look at it, this is a dirty trick—and leads straight to the conclusion that, to control confusion, you must first have some. And this idea of theirs appears to be a quick way to generate plenty of confusion.

Some of us have complained about confusion in power plants, too, and methods have been set up to detect it and eliminate it. We recall one plant where the chief went so far he had everybody in the place check in for a report three times a day to make certain all hands were staying "unconfused."

Well, there's really only one sure way to prevent confusion and waste, and that is to hire capable assistants, and to buy good, sound equipment. Competent supervision, adequate training and careful organization of a capable staff will always bring desired results, provided you have as a foundation a well-built plant. Conversely, poor machines will confuse a decent staff, and it works the other way 'round, too.

All of this costs money, of course. It takes time and dollars to select and train engineers, to set up and organize a group, to evaluate published information on equipment and services. But the return, in terms of fuel savings, shutdowns avoided and easier maintenance, more than justifies the initial expense.

I think it's a pretty fundamental rule that fancy techniques can never replace practical, responsible management.

George Edwards

Engineer

# The RIGHT INSULATION, correctly applied, NEVER GROWS OLD

**ENGINEERING:** In planning your insulation job, first call in an experienced insulation engineer. Johns-Manville . . . Insulation Headquarters for more than 75 years . . . maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job . . . make it "*right* the *first* time."

**RIGHT INSULATION:** Any insulation will save money —but only the *right* one will save the most for the longest period of time. J-M 85% Magnesia is the most widely used of all industrial insulating materials . . . and one of a wide range of J-M insulations for every service and temperature.

**CORRECT APPLICATION:** No insulation is better than the man who installs it. J-M Insulation Applicators are industry's first choice for completely efficient jobs because: (1) They are trained in all phases of insulation application; (2) They employ skilled mechanics and up-to-date application methods. You can rely on them for thorough, dependable and speedy workmanship.

**35 YEARS YOUNG!** J-M 85% Magnesia was applied to pipes of the Eclipse Mill Company, Everett, Washington, back in 1912. Because this job was *engineered right* and *applied right,* it is still providing dependable insulation . . . still keeping fuel costs low. Get expert help with *your* insulation problem by writing to Johns-Manville, Box 290, New York 16, N. Y.

## JOHNS-MANVILLE *First in* INSULATIONS

# POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

## Swiss Build 20,000-Kw Semiclosed Gas Turbine

▶ One of the largest Swiss power companies, the N O K, has decided to build a new thermal power station in northeastern part of Switzerland. This plant will supplement the winter energy obtained from existing hydroelectric stations. Its power unit will be a 20,000-kw plant, built by Sulzer Bros, that will operate on the special high-pressure cycle developed by that firm. It will drive a 25,000-kva generator. It is expected that the plant will be put in service during winter of 1949-1950.

Also, Sulzer Bros expect to have in operation, long before the above 20,000-kw stationary unit, a marine gas-turbine plant of about 7000 hp that will be put into a ship after shop tests.

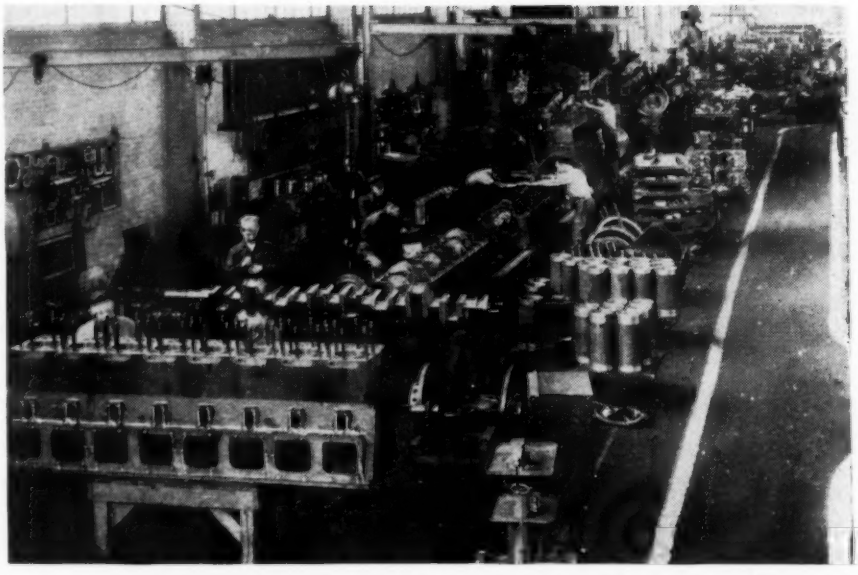
## Laboratories Study Future Synthetic Fuels

Synthetic gasoline and diesel fuel will soon be commercially manufactured from natural gas. The first commercial natural-gas synthesis plant is now being built in Texas, with a second plant soon to follow in Kansas. Private industry has adapted the basic synthesis process to natural gas not only as a means of making a substantial contribution to our oil resources but also as a step toward further development of the coal process. Synthesis from natural gas has been brought to a point at which its gasoline may soon be competitive with gasoline from petroleum.

Hydrocarbon synthesis is an American modification of a German process that was first announced by Franz Fischer and Hans Tropsch in 1926, and began commercial operation in 1933 at Oberhausen in the Ruhr. Despite the large and complex layout required, the Fischer-Tropsch process was essentially simple. It consisted of two stages. The first was that used in every gas works to produce ordinary "water gas" from coal. In the second, the gas was catalyzed into gasoline and other products.

By American engineering standards,

(*Continued on page* 168)



## DIESELS MOVE DOWN ASSEMBLY LINE

**From a stripped engine bed to completed engine on a flat car, diesel and gas engines now are produced on this modern assembly line at plant of Superior Engine Div, National Supply Co, Springfield, Ohio. At end of line the last part, the cylinder-head cover, is put on and diesel is moved to the test stand**

## COMING EVENTS

**June 9-13—American Institute of Electrical Engineers,** summer meeting, Mount Royal Hotel, Montreal, Que., Canada. H H Henline, 33 W 39th St, New York 18, N. Y.

**June 15-19—American Society of Mechanical Engineers,** semiannual meeting, Hotel Stevens, Chicago, Ill. John R Michel, chairman, c/o Commonwealth Edison Co, Chicago, Ill.

**June 16-18—American Boiler Manufacturers Assn,** 59th annual meeting, French Lick Springs Hotel, French Lick, Ind. A C Baker, secretary, 264 Rockefeller Bldg, Cleveland, Ohio.

**June 16-18—Stoker Manufacturers' Assn,** annual meeting, Lookout Mountain Hotel, Lookout Mountain, Tenn. Walter Sorman, president, 307 N Michigan Ave, Chicago 1, Ill.

**June 16-20—American Society for Testing Materials,** 50th annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City. Robert J Painter, asst secretary, 1916 Race St, Philadelphia.

**June 16-20—11th Prime Mover Conference, Woodward Governor Co,** Rockford, Ill. Norman Noling, Woodward Governor Co, Rockford, Ill.

**June 24-27—National District Heating Assn,** 38th annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. John F. Collins Jr, NDHA, 827 N Euclid Ave, Pittsburgh, Pa.

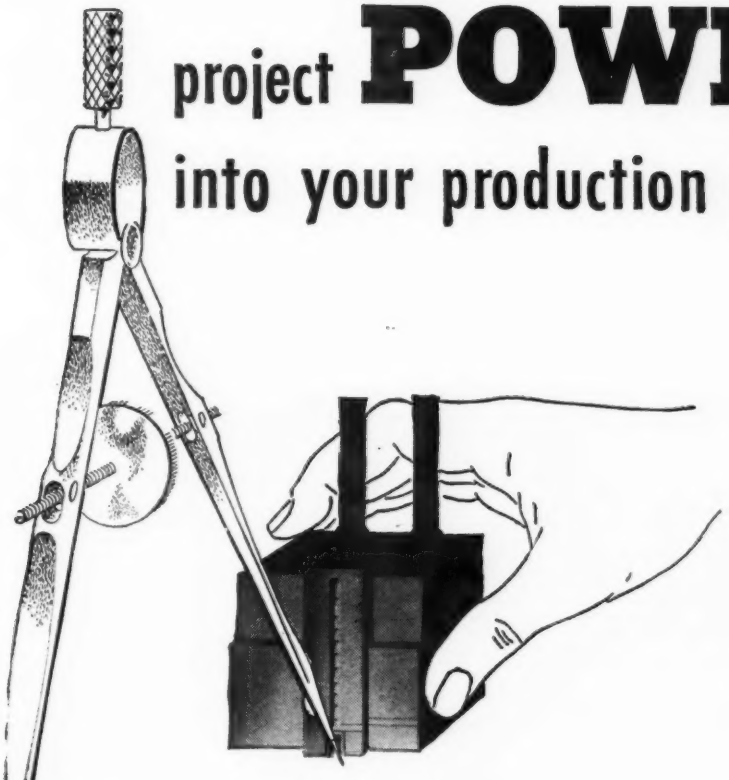
**July 7-9—Smoke Prevention Assn of America,** annual meeting, Royal York Hotel, Toronto, Ont., Canada. Columbus D. Behan, secretary, 159 N Clark St, Chicago, Ill.

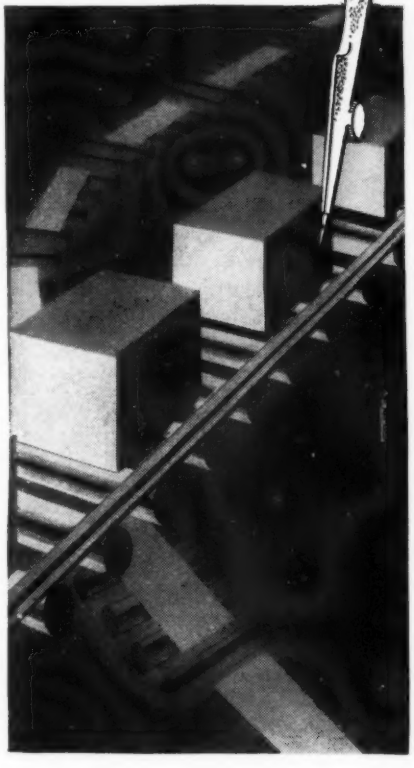
**Aug 17—New England States Assn of Power Engineers,** meeting, Hotel Statler, Boston, Mass. Dudley G Kimball, chairman, 55 Clifton St, Dorchester 25, Mass.

**Aug 25-28—National Assn of Power Engineers,** meeting, Hotel Statler, Boston, Mass. A F Thompson, director of exhibits, 176 W Adams St, Chicago 3.

**Aug 26-29—American Institute of Electrical Engineers,** Pacific general meeting, Hotel San Diego, San Diego, Calif. P. M. Klauber, 233 W Juniper St, San Diego 1, Calif.

# project **POWER** into your production planning





Since modern production planning requires projection of a program over a long period of time it's quite logical that power requirements will be based on a similar long-range study of peak demands for all of the industrial services supplied by modern boiler and power plants.

Because power plant construction, expansion, or modernization does require advance planning *after* your Consulting Engineers have completed their specifications and detail drawings, it's never too early to call in Dravo Power Plant Specialists. When you draw upon Dravo experience during prior planning you can be assured that power and boiler plant construction will be completely integrated with the over-all project—you can schedule your future power requirements and depend upon Dravo to maintain the construction pace to meet those schedules.

There are important advantages to be gained when Dravo contract methods and construction techniques are applied to your power or boiler plant projects. Additional details of these methods and techniques are reviewed in Bulletin DR-504.

DRAVO

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Power and Boiler Plants • Pumping Stations • Power Plant and Contractors' Equipment • Direct-Fired Heaters
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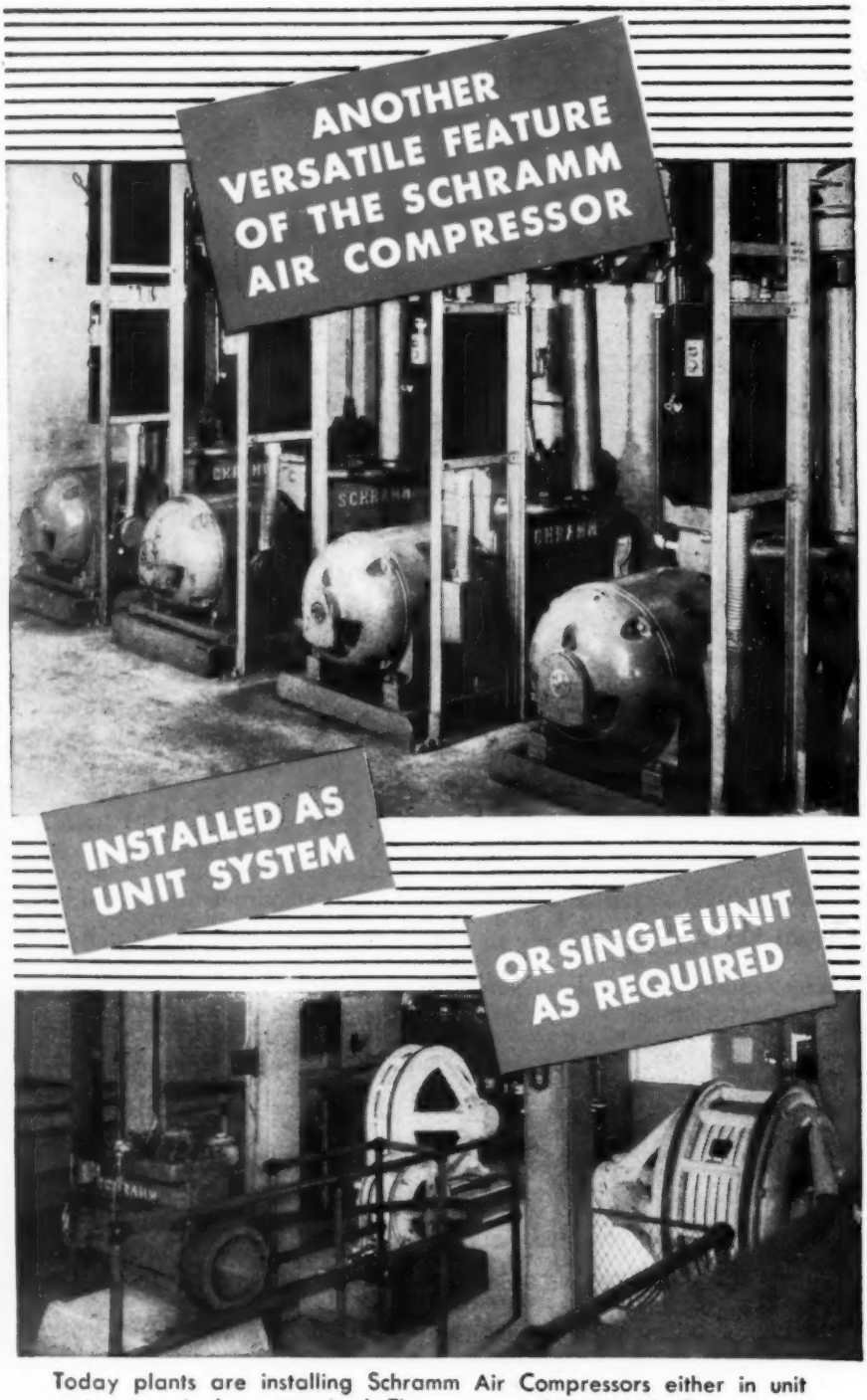


Today plants are installing Schramm Air Compressors either in unit systems or singly as required. Thus you see the versatile Schramm at work in a variety of plants, both large and small.

Regardless of your need for compressed air, there is a Schramm Air Compressor to do the work . . . the stationary units ranging in size from 2 to 600 cu. ft. displacement . . . the portable units (for use in construction work) from 20 to 420 cu. ft. of actual air.

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SCHRAMM INC.

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## Argument Corner

(*Continued from page* 124)

*Problem:* $\frac{16 \times 721}{.89 \times 1.73}$

**a.** Multiply and divide: First multiply; slide left so $2 + 3 = 5$. Second, divide by .89. Slide left so $5 - 0 = 5$. Third, divide by 1.73. Slide left so $5 - 1 = 4$. Ans, 7500.

**b.** Divide, multiply and divide. First, left so $2 - 0 = 2$. Second, left so $2 + 3 = 5$. Third, left so $5 - 1 = 4$ places, or 7500.

*San Francisco, Calif.* A C BULLEN

EDITOR'S NOTE: We are familiar with Reader Bullen's pointing-off method. It was not included in the slide-rule series because we thought it complicated for slide-rule beginners. It is printed here, however, as some readers might like to try it.

## Compressed-Air Explosion Comes From Lubrication

I WAS INTERESTED in the answers to the question, "What is the cause of compressed-air explosion?", Reader's Problems, p 120, Nov, POWER. Before the replies were made someone should have inquired about the discharge pressure and the number of stages. These conditions have an important bearing on the problem. Apparently no distinction was made between single and multistage compressors. If the pressure is relatively low, requiring only a single-stage compressor, the answers as published are quite satisfactory. But if the pressure is high enough to require multistage compression, the conventional answers will not do.

It is, of course, essential to use a minimum of good quality oil, but what may be satisfactory for single-stage compression will not do for multistage. A reference book of one good authority on compression states, "For average normal conditions, the oil should be a medium-bodied pure mineral oil of the highest quality, not compounded with fixed oils such as animal or vegetable." But a little later, the book states, "Under certain conditions the use of a mineral oil which has been compounded with a small percentage of fixed oil is recommended. Such an oil will maintain better lubrication of a wet surface than a pure mineral oil, and is recommended for use with multistage high-pressure air compressors where the air in the higher stages may be wet."

These two statements are inconsistent. If they are accepted at face value it seems necessary to use a compound oil

# LOOK TO CHAPMAN

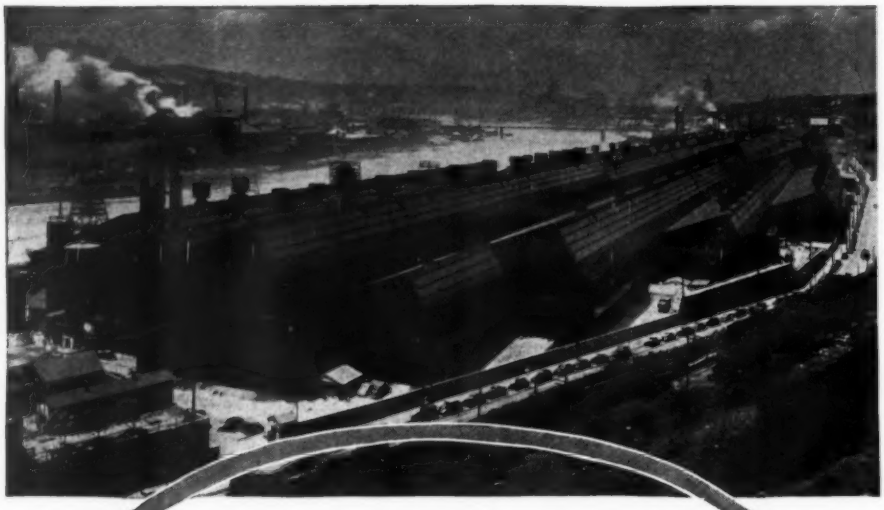
## *For the BEST in Steel Valves*

You'll find that it's always safe to *look to Chapman* when you're considering valves of *any* type. In steel valves—whether gate, globe, angle, or check—the Chapman Standard Line will provide you with an unusually wide variety for almost every engineering requirement.

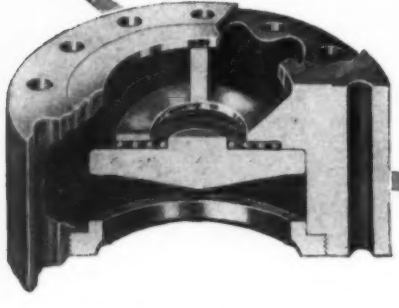
That's because the Chapman Standard Line has been built up through long years of research and development.

If you need a special, custom-made valve, *look to Chapman* for help in its development, but be sure *first* to consult the Chapman Standard Line, because you may find there *the exact valve for your joo.*

**The Chapman Valve Manufacturing Co., Indian Orchard, Mass.**



*Steel Plants*
**... are one of the biggest users of THE WILLIAMS-HAGER *flanged* SILENT CHECK VALVES**



While hundreds of Williams-Hager Flanged Silent Check Valves are used for various applications—one of the most important is on *High Pressure Descaling System in Strip Mills.* These valves will operate effectively in any position—horizontal, vertical, upside down or angular—and will remain tight under every condition of service and pressure. When "Water Hammer" occurs look to Williams-Hager Flanged Silent Check Valves for the economical answer.

***Write for new bulletin!***

**THE WILLIAMS GAUGE CO.**

**Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns**

**2055 PENNSYLVANIA AVE. • PITTSBURGH (12), PA.**

in multistage compressors, although it has the unfortunate characteristic of carbonizing readily. Troubles then become accumulative because if there is a high degree of wetness, more oil must be used and more carbon will form on the valves and in the intercoolers. For convenience, the same oil would be used in the first stage where it would be unsuitable for the service conditions.

In multistage compression, therefore, one satisfactory solution to the carbon problem is the application of efficient separation between stages so the air entering the higher stages does not have a greater degree of saturation than the air entering the first stage. If this application is made a minimum amount of a high-grade straight mineral oil can be used throughout all stages, and thus reduce carbon trouble to an absolute minimum. I assume other variables are under control.

*Charleston, W. Va.* WALTER COOPEY

## Handles Hard Water With Acid Treatment

WITH HARDNESS OF 994 PPM, *JEC's* water is hard indeed (p 114, March 1947). In fact, without some sort of threshold conditioning (see my letter on p 115, March) hardness of this magnitude is almost unmanageable. Although a number of patented treatments are available an intelligent application of threshold acid treatment works satisfactorily. The quantity of acid added is a direct function of the hardness present; therefore 994-ppm hardness requires ten times as much acid as 99.4 ppm. Thus *JEC's* water requires approximately 900 ppm of acid.

Also, the zeolite bed must contain 400 instead of 40 cu ft of zeolite. Under such conditions an area of about 100 sq ft with a 4-ft depth would be best. A bed of this size should be regenerated daily.

*Paterson, N. J.* F M GIORDANO

## Construction Errors Affect Rotor Bars

BROKEN BARS in squirel-cage rotors (Reader's Problems, p 116, Sept 1946 POWER) may be caused by one or more defects in design or construction, or both. In general, main causes of trouble are (1) slack bars (2) unsupported short-circuit rings (3) too high brazing temperature.

First point is of considerable importance. Bars should be of hard-drawn copper, rectangular section, and have no radius on the edges. The hard-drawn quality is merely chosen so the

# NOW! QUICK DELIVERY

## On Small TURBINE DRIVES*

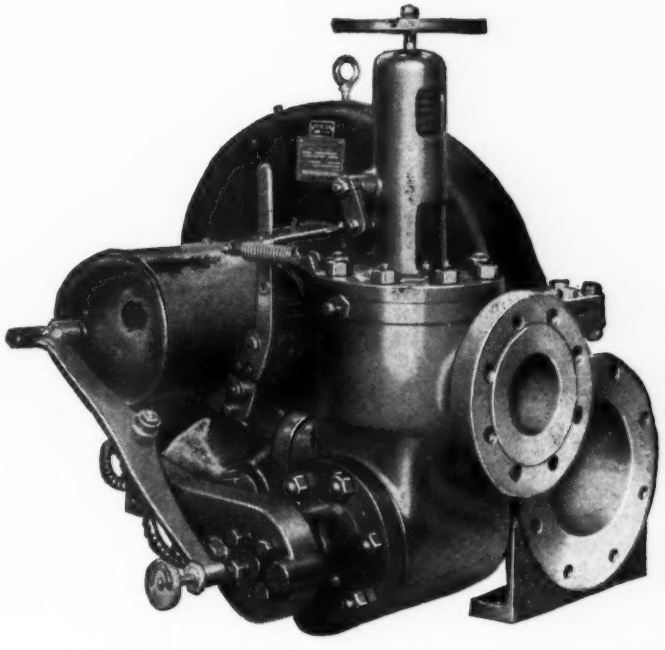
**Yes, we mean it!** Now you can get standard (single-stage, shaft-governed) turbines in a hurry—average delivery time is *15 weeks* from receipt of order and complete application information. If you have an urgent replacement problem we'll do better than that. In some emergencies, shipment has been made in less than half average time.

**STANDARDIZATION DOES IT**—Behind this drastic reduction in manufacturing time are two major factors: a new turbine plant now geared up for full production, and standardization of design. This standardization (on single-stage, shaft-governed turbines) has eliminated special calculations and drafting, has streamlined factory operations, and made possible the stocking of practically all component parts.

**YOU GET THESE FEATURES**—G-E turbines for mechanical drives are made with the same precision and attention to detail used in the building of large turbines for power generation. For example:

- to prevent steam leaks without use of sealing compound, casings are given extra-smooth machine finishing.
- the built-in trip valve is provided with alloy seat and trim to resist corrosion and erosion.
- horizontally split packing assemblies permit quick inspection and removal of packings.
- completed turbines are tested thoroughly at the factory—your assurance that they will be ready to start work when installed.

**AT YOUR SERVICE**—Our turbine specialists are ready to assist you in the selection of a turbine drive, and are in position to give you fast shipment on standard designs. Call or wire the nearest G-E Sales Office, or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.



*STANDARD (single-stage, shaft-governed) mechanical-drive turbines.

Standard turbines are applicable, in general, for ratings up to 800 hp. The shaft governor used on standard turbines has a regulation of 8 per cent and a speed adjustment range of 1.1 to 1.

The standard units are part of a complete line of G-E turbines, covering a full range of horsepower ratings and a wide variety of steam and speed conditions. Characteristics of governor types available (in addition to the standard shaft governor) are as follows:

**OIL GOVERNOR**
Regulation: 8%
Range of adjustment: 3 to 1

**OIL RELAYED-GOVERNOR**
Regulation: 4%
Range of adjustment: 8 to 1

**ELECTRIC GOVERNOR**
Regulation: 0.5%
Range of adjustment: 30 to 1

The extremely fast delivery of 15 weeks applies to the standard (shaft-governed) units only. Delivery time of other units is longer depending upon engineering and manufacturing requirements.

# GENERAL ELECTRIC

220-17

Over three years ago a large oil refinery installed 39 non-equalizing expansion joints in its reactor piping. Within six months these joints failed . . . unable to withstand the terrific punishment of 1125° F vapor temperatures. These were replaced by Zallea Expansion Joints. Today, over 2½ years later, these Zallea Expansion Joints, one of which is shown in the above unretouched photo, are giving trouble-free performance.

Actually, both joints *look* alike . . . same alloy steel, same physical appearance. But that's where similarity ends. The difference lies in the heat-treatment and *control* exercised in the manufacturing process of Zallea Expansion Joints. It's that *control* that makes every Zallea Expansion Joint the ideal joint for absorbing contraction and expansion of pipe lines due to temperature changes. Be *sure* of trouble-free operation . . . specify ZALLEA.

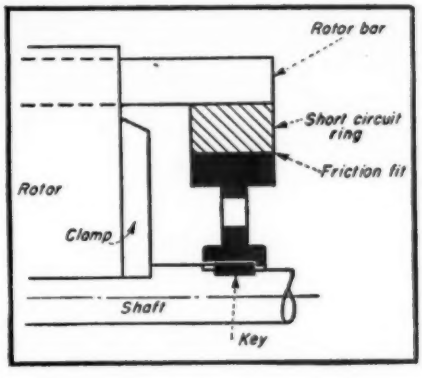
*Zallea Corrugated Expansion Joints are made in non-equalizing, self-equalizing and duo-equalizing types, depending upon the conditions under which they must operate . . . of copper, stainless steels and other corrosion-resistant alloys . . . diameters from 4" to 72" . . . traverses up to 7½" . . . for pressures from vacuum to 300 psi . . . for temperatures from sub-zero to 1600° F. Let us quote on your requirements.* Zallea Brothers & Johnson, 814 Locust Street, Wilmington 99, Del.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY


bars can be a medium-drive fit in the slots without being bent. The amount of clearance between bars and slots varies with the rotor type. For example, when a rotor having skewed slots is required, the clearance must be slightly more than if straight slots are used. As a guide on skewed slots, bar width and depth should be 0.016 in. less than the slot. On straight slots the clearance should be .012 in.

Second point, which is also of major importance, relates to the short-circuiting rings. The method of construction is influenced by type of load and size of short-circuit rings. Where a motor has a duty cycle of continuous acceleration and deceleration there is a tendency for the speed of short-circuit rings to lag slightly behind the rotor body, with the result that the bar extensions driving the rings become over-stressed. To overcome this trouble the rings should be keyed to the shaft, as in the sketch,




or locked to the rotor clamp ring. A friction fit as shown is usually sufficient, but if the short-circuit rings have a large section, a key should also be used to help take the force. Rings should not be locked so they are not free to slide endwise because of temperature changes.

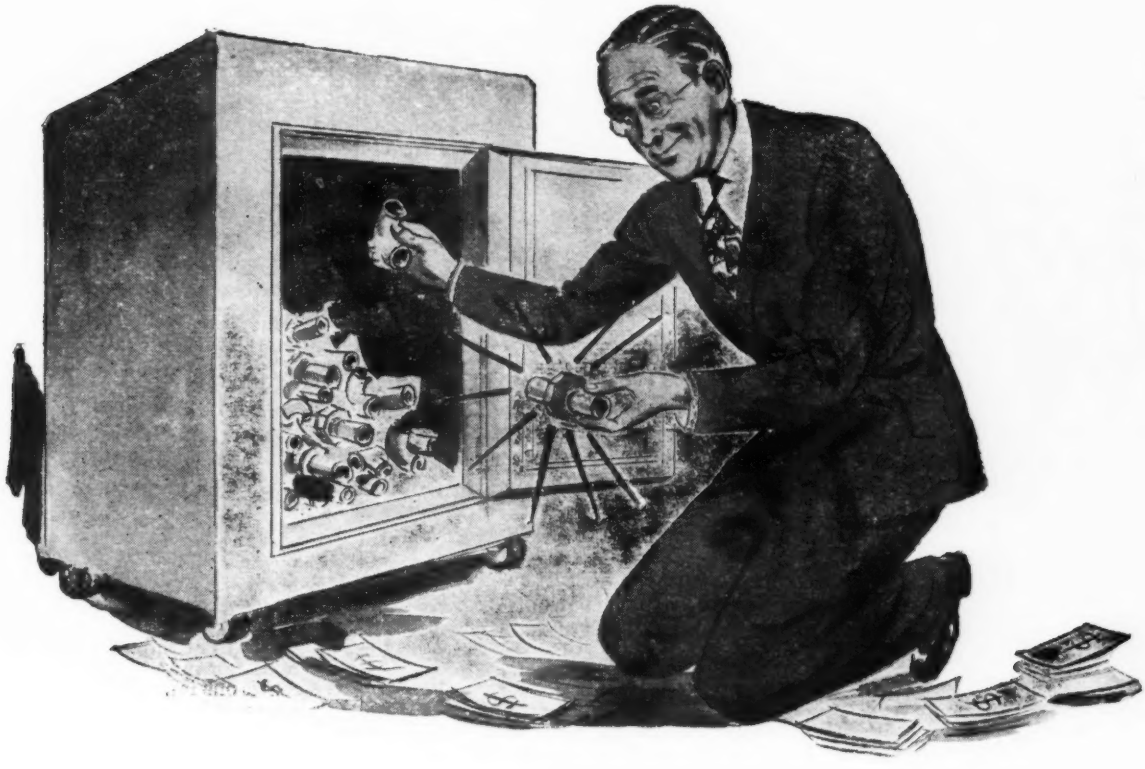
The third point is also important. Some manufacturers use a high melting point (1500-1650F) brazing metal. These temperatures may cause crystallization of the bars. I suggest materials of a lower melting point to be successful.

*Colchester, England* L GREENWOOD

## Recommends Pump For Hard Water

ACCORDING TO JEC (Reader's Problems, p 114, Jan 1947, POWER) his 6-in. well yields water that is high in calcium-carbonate hardness. If I interpret his description correctly, it has a 50-ft drop or draw down from normal water level when pumped, which indi-

# FITTINGS ARE SCARCE!



## save 7 per trap with SUPER-SILVERTOPS

● One way to conserve those "more-precious-than-gold" pipe fittings—make them go farther—is by simplifying with Super-Silvertop Steam Traps.

As you can see in the photos at the right, one nipple and one union on a Super-Silvertop takes the place of 5 nipples, 4 elbows and 2 unions on an ordinary inverted bucket trap. Super-Silvertop gives you this saving because of the built-in U-tube—designed into the trap at the factory instead of hand-made outside the trap at your plant.

Super-Silvertop design gives simplified piping in all sizes of traps, and without the weakness of cored passages or split (pierced) gaskets.

Do you want to save fittings and still get efficient trapping? Then investigate Super-Silvertop. Complete details are included in the helpful book *"How To Choose a Steam Trap"*—send for your free copy.

**THE V. D. ANDERSON COMPANY**
**1934 West 96th Street, Cleveland 2, Ohio**

*and here's how*

Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

**SUPER-SILVERTOP**
**STEAM TRAPS**

# HELICOID SCORES AGAIN!

• The new ACALOY case is a high-compression molded aluminum alloy. Treated by a patented process to prevent corrosion. Durable baked-on finish. Withstands 1200 hours salt spray test.

Weather-proof. Neoprene sealing gasket. 18-8 stainless steel snap ring. Greater strength—less weight. It's another Helicoid exclusive.

With back flange for wall mounting, or without flange for stem mounting. Safety blow-out discs optional.

Specify Helicoid gages in the new ACALOY case. They will reduce your maintenance expense.
. . . the Helicoid movement, with no gear teeth to wear out, lasts many times longer.

*Send for the new catalog that tells the complete story of Helicoid.*

Only Helicoid pressure gages have the Helicoid movement.

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK


cates the supply is not too plentiful.

I believe a submerged turbine or centrifugal pump will cause less scale precipitation inside the delivery pipe than an air lift.

Water containing calcium-carbonate hardness is easily softened by the use of hydrated lime and a small amount of sulphate of iron, which acts as a coagulant. A 20,000-gal reservoir should be provided for agitation, sedimentation, and draw off. If *JEC's* water still contains sulphate hardness, this can be exchanged in a zeolite softener to the desired extent.

If *JEC* prefers to use air lift to pump 1500 imperial gallons per hour from his well, I offer the following calculations:

| *Assumed conditions* | *Ft* |
|---|---|
| Static head or normal water level | 75 |
| Drop or draw down | 10 |
| Elevation above ground | 15 |
| Total lift | 100 |

*Calculations for Above Conditions*

| | |
|---|---|
| Air-pipe submergence, 1¼ in. | 235 ft |
| Discharge-pipe submergence, 3-in | 255 ft |
| Starting air pressure | 72 psi |
| Operating air pressure | 67.5 psi |
| Air to lift one imperial gal | 0.702 cu ft |
| Air vol per min to pump 1500 imperial gph | 17.55 cfm |
| Air vol to pump 3000 imperial gph | 35.1 cfm |
| Theoretical hp to pump 1500 imperial gph | 2.571 hp |
| Theoretical hp to pump 3000 imperial gph | 5.142 hp |

I suggest a 5-hp motor in first case, and for higher delivery a 7½-hp unit.

*Memphis, Tenn.* C DEMERE

## Engineer's Bookshelf

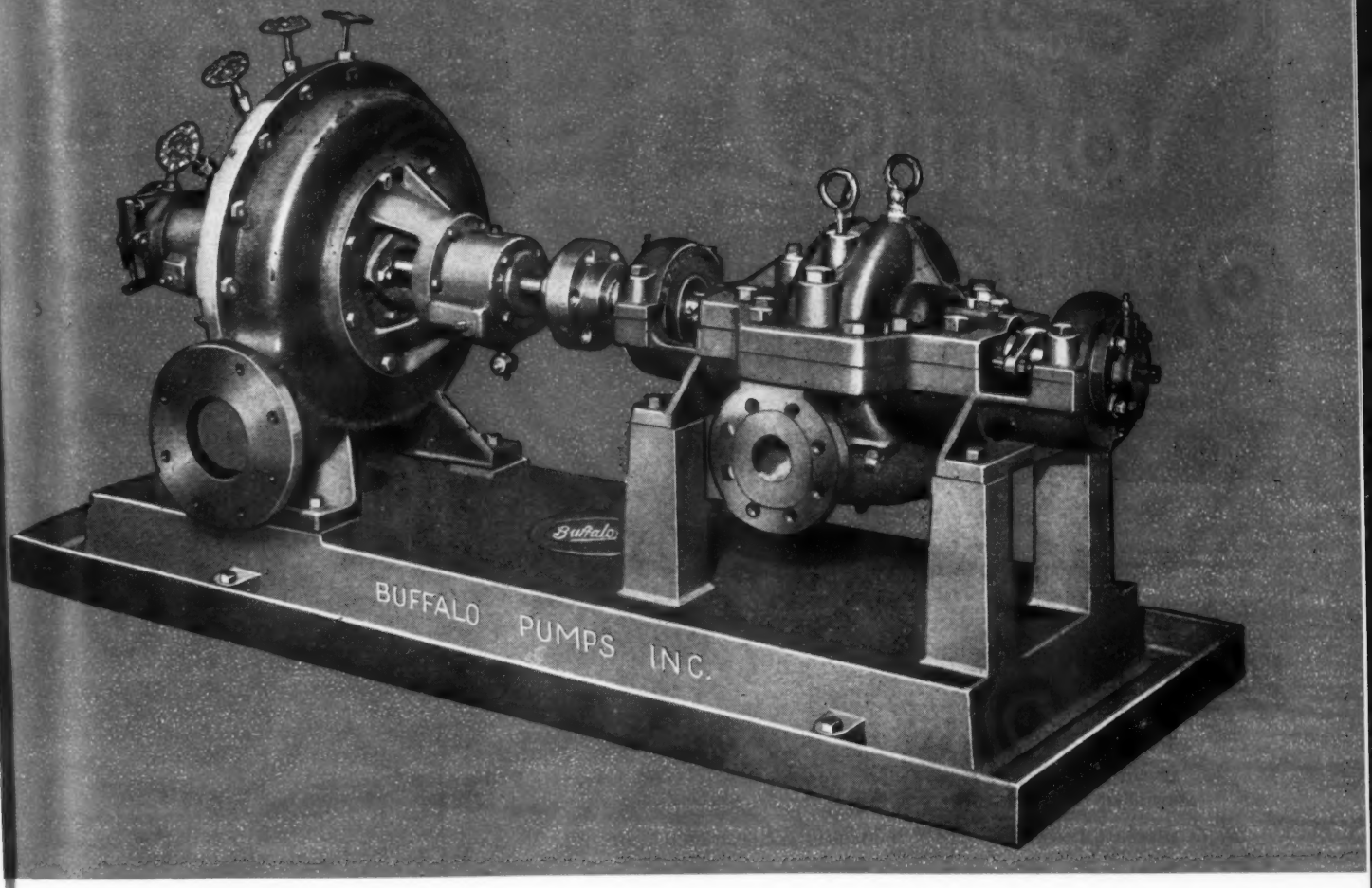
(*Continued from page* 130)

practical and the engineering textbook. It is the result of teaching for ten years an evening course in industrial electronics at the University of Wisconsin.

Fundamental principles are stressed more than specific applications, but always with student limitations in mind. The author also attempts to dispel the belief, prevalent among many familiar with ordinary lighting, power and control circuits, that electronic circuits are a different breed of cat and that the old laws no longer hold. To this end, the first part of the book deals with the fundamentals of electric circuits, mutual- and self-inductance, resistance, capacitance, ac-wave shapes, transformers and nonlinear conductors as a basis for consideration of electronic circuits. This section is followed by detailed discussion of electron-tube characteristics and electronic circuits for a wide field of applications.

Mathematical treatment has been kept to a minimum necessary for the design of electron circuits, and in this treatment nothing more than simple algebra is used. The practical student, seeking more in-

# To handle clear liquids at high pressures—




In the countless and all-important industrial pumping jobs requiring the handling of clear liquids—any temperatures—up to 1500′ heads—from 20 to 900 g.p.m.—you will find "Buffalo" Class "RR" Pumps the long-term, efficient answer. Reports from users show efficiencies of 75% and higher, and "endurance records" of years of service with no attention other than lubrication!

"Buffalo" Class "RR" Pumps are built with extra large bearings, extra deep stuffing boxes to hold more packing—extra sturdy rotors and shafts. Their perfect hydraulic balance and alignment insures quiet, vibrationless performance.

We invite you to look over the sectional views, elevations and specifications on Buffalo "RR" two- and four-stage pumps in *Bulletin 980-B.* Send for it, and see why these "Buffalo" Pumps deliver *longer* and deliver *more!*

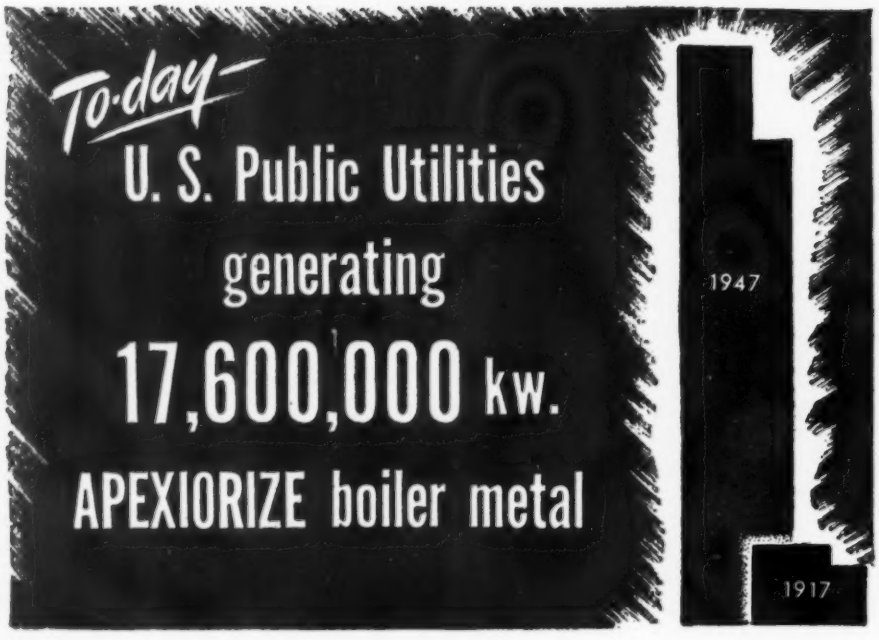
## BUFFALO PUMPS, INC.

**488 BROADWAY, BUFFALO, N. Y.**

***Canada Pumps Ltd., Kitchener, Ont.***

"Buffalo"

## CLASS "RR" MULTISTAGE PUMPS




MAXIMUM AVAILABILITY

With tubes and drums APEXIORized, boilers go on the line to stay, secure against the slow developing and often undetected corrosion that may occur in high-pressure-temperature units under apparent ideal conditions.

HIGH-EFFICIENCY PERFORMANCE

Even highest operating standards are bettered when boiler steel is preserved dry and sound beneath APEXIOR NUMBER 1's smooth, deposit-resistant surface, for APEXIORized metal stays insulation-free for better heat transfer — added thoroughness and ease of inspection.

LOW-COST MAINTENANCE

Because deposits do not bond to coated steel, an APEXIORized boiler remains in service longer between cleaning outages, cleans more easily and thoroughly, and goes back into service faster at less man-hour cost.

*Dampney protective surfacing materials include —*

*APEXIOR NUMBER 1 — for boiler interiors*

*APEXIOR NUMBER 3 — for cold-water tank interiors*

*THUR-MA-LOX — for air heaters, breechings, stacks*

APEXIOR

THE DAMPNEY COMPANY OF AMERICA


formation on electronic circuits than is given in elementary books, and the electrical engineer, who finished his schooling before electronics attained their present importance, will find this book useful.

### Advanced Mathematics

APPLIED MATHEMATICS FOR ENGINEERS AND PHYSICISTS (1946). *By Louis A Pipes, Research and electronics division, Hughes Aircraft Co.* 618 *pp.* 6x9, *illust, cloth,* $5.50. *McGraw-Hill Book Co.* 330 *W* 42*nd St, New York* 18, *N. Y.*

This text illustrates the use of mathematical analysis in the solution of technical problems. These cover the fields of electrical, mechanical and civil engineering. The mathematical techniques used by the scientific engineer and physicist have resulted from the remarkable developments in the research laboratories of the nation.

These advanced methods include among others matrix algebra, operational methods, orthogonal functions, partial differential equations, Bessel functions, vector analysis and the complex variable. The text primarily emphasizes the *use* of mathematical techniques; because of lack of space rigorous proofs of all mathematical statements are not included. Where such proofs are desired, however, bibliographic references at the end of various chapters will direct the student to them.

### Canadian Hydro

PACIFIC DRAINAGE (1946) 317 *pp,* 6½x9½, *largely tables, paper binding.* $1.00. *Published by Dominion Water and Power Bureau, Ottawa, Ont., Canada.*

This is Water Resources Paper No. 94, and is the result of hydrometric investigations in the province of British Columbia for the climatic years 1940-41 and 1941-1942. It is largely a collection of tables giving stream-flow data on rivers in British Columbia that drain into the Pacific Ocean. On rivers that have drainage in Canada and the U. S., stream-flow data were collected in cooperation with the U. S. Geological Survey.

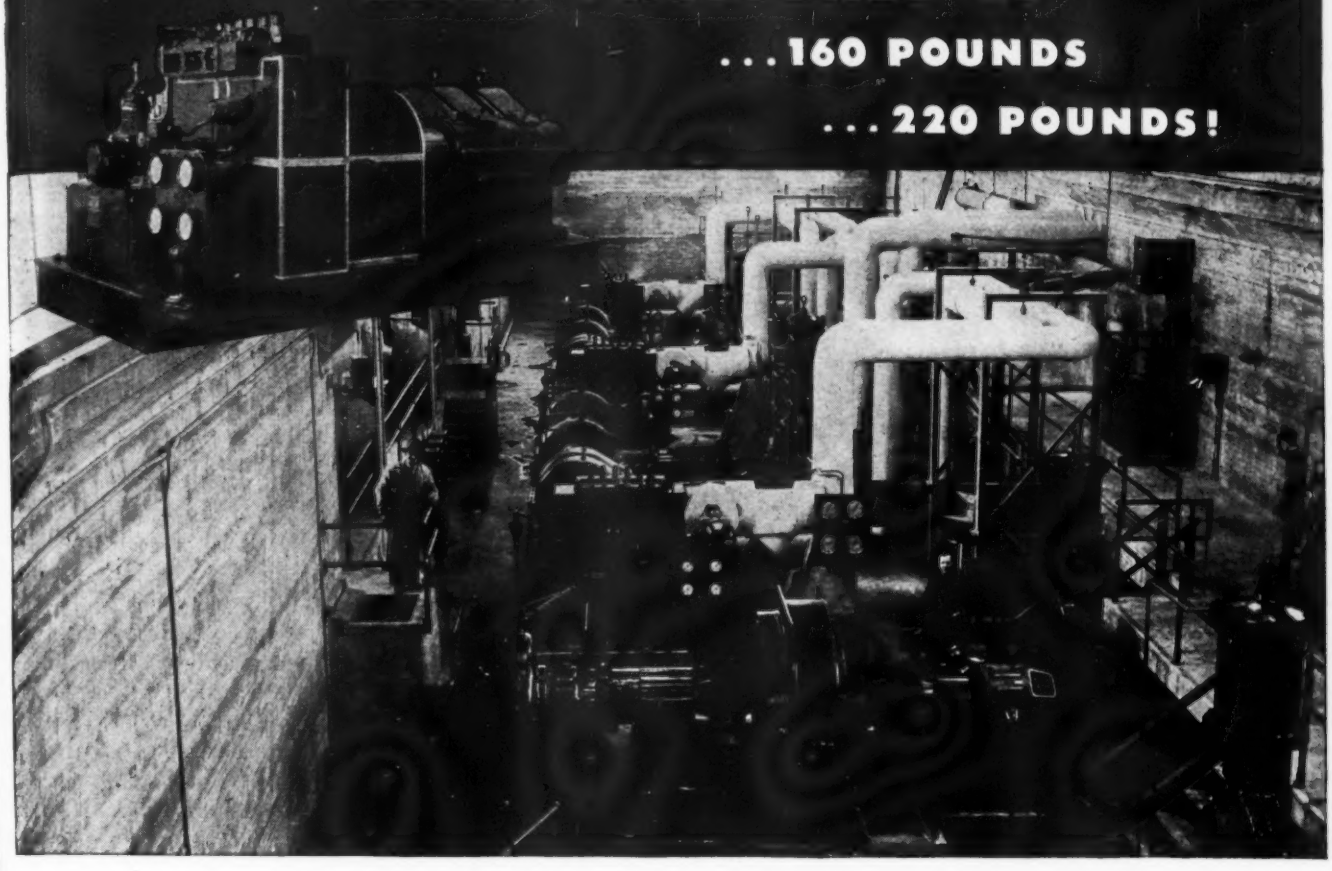
### Industrial Electronics

ELECTRONICS FOR INDUSTRY (1947) *By Waldemar 1 Bendz, electronic engineer, Westinghouse Electric Corp.* 501 *pp,* 5½x 8½, *illust, cloth.* $5. *John Wiley & Sons,* 440-4th *Ave, New York* 16, *N. Y.*

Technical books may be divided roughly into three classes; theoretical, practical and in-between. This one, which falls between the theoretical and practical, deals with types and functions of electronic tubes, the fundamentals of rectifiers, amplifiers, oscillators, basic-control circuits, and the application of high frequency for induction and dielectric heating.

Emphasis is placed on explanation of principles that apply to industrial-electronic equipment. The book is the result of the authors instructing several classes designed to acquaint practicing engineers, already familiar with the fundamentals of electric circuits, with the principles of industrial

# BACK PRESSURES UP
## ...160 POUNDS
## ...220 POUNDS!



***Result: Lowest power costs at new synthetic rubber plant with Worthington-Moore turbines***

In Canada's new government-owned synthetic rubber plant, operated by Polymer Corporation, Ltd., Worthington-Moore high back pressure steam turbines have permitted considerable savings in power costs. In this, Canada's largest steam plant installation, engineered by H. G. Acres and Company, power is produced as a by-product, since all exhaust steam is used for plant operation.

Three Worthington-Moore 1650-hp. geared multi-stage turbines are illustrated above as installed. These topping turbines operate with steam at 400 lbs. initial pressure, 650°F. temperature, and exhaust against 160 lbs. back pressure. Two 1000-hp. Worthington-Moore turbines, exhausting to 220 lbs. back pressure, were also selected.

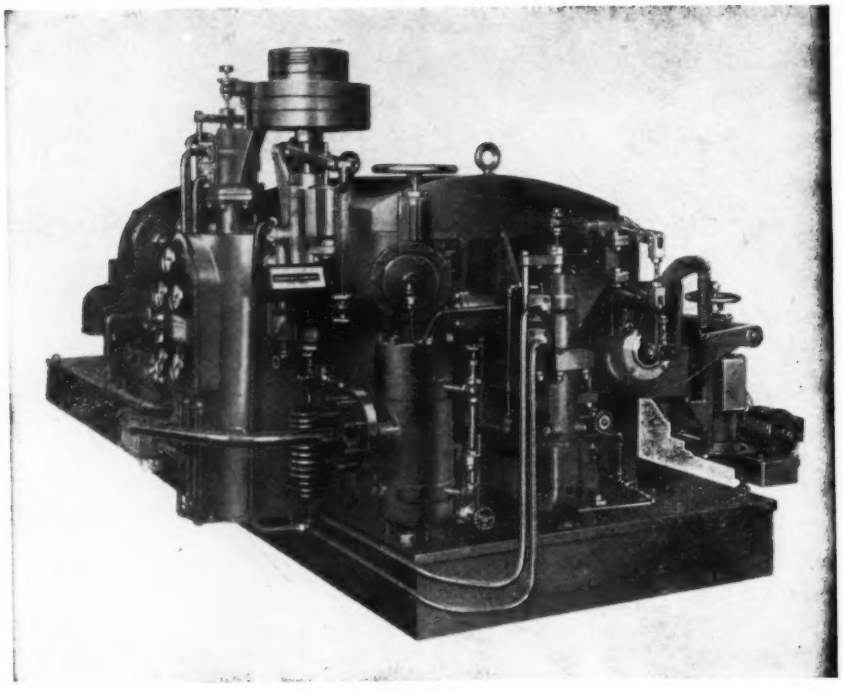
**Save Money in Modernizing Steam Plants**

Worthington-Moore turbines operating against unusually high back pressures have enabled many plants to install modern high-pressure boilers without scrapping existing low-pressure apparatus. Write for complete details. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

**WORTHINGTON**

T4-9

A GREAT TEAM IN STEAM



# LARGE TURBINE PERFORMANCE FOR THE SMALL PLANT

An outstanding advantage of Murray Turbines is that they give the small plant many of the desirable operating economies enjoyed by larger plants.

The illustration above shows a typical job of this kind—a 175 KW Murray Extraction Turbine installed in a midwestern packing plant.

This modern unit operates with steam at 235 lb. pressure—500 deg. F. total temperature, and exhausts at 27 in. vacuum. Steam is extracted automatically at 60 lb. pressure.

*Let our engineers cooperate in smoothing out your power problems.*

**MURRAY IRON WORKS COMPANY**

**BURLINGTON, IOWA**

*Builders of Steam Power Equipment for Three Quarters of a Century*

electronic devices and their circuits. Many of the most frequently used basic circuits are discussed, and circuits employed in several commercial electronic devices are explained in detail.

Mathematics has been used sparingly and only when necessary, except in the chapter on high-frequency heating where calculations for induction and dielectric heating are given. Outside of this section the treatment is practical and well suited both to electricians with some technical background and to practicing engineers who want explanations of electronic devices and circuits and how they function.

### Turbines in Italy

PROGRESS OF STEAM TURBINES. *By Prof Ing V Rubbo. Paper cover, 6½x8½ in., 233 pp, many diagrams and tables. Published by International Assn of Medical Press, 47 Via Due Macelli, Rome, Italy.*

Not many power engineers read Italian, which is unfortunate because this book contains an amazing amount of material on the theory and design of steam turbines —primarily European practice, of course.

Considering the economic situation in Italy, the publication of such a complete work of definite technical character is greatly to the credit of the publishers.

### Bearing Testing

SYMPOSIUM ON TESTING OF BEARINGS (1947) *72 pp, 6x9 in., illust, stiff paper.* $1.50. *American Society of Testing Materials, 1916 Race St, Philadelphia 3, Pa.*

The American Society of Testing Materials held a symposium on testing of bearings to make available latest information on tests used, equipment developed, and to correlate laboratory tests with field service. The five papers comprising the symposium include life testing of plain bearing for automotive engines, fatigue-testing machines for ball and roller bearings, metallographic observation of ball-bearing fatigue phenomena, fatigue testing of roller bearings, and testing of bearings under controlled load. Several pages of discussion as questions and answers add considerably to the value of this book.

### Power Factor

POWER FACTOR IN YOUR PLANT (1946) *By W C King. 214 pp, 6x9 in., 126 illust, 13 tables, cloth.* $3. *Cornell-Dubilier Electric Corp, South Plainfield, N. J.*

According to its introduction, this book is based on questions asked the author by Joe, chief electrician at Acme Manufacturing Co. Joe and his armature winder got interested in power factor, and wanted a book on the subject they could understand. So Joe persuaded the author to undertake the job. Twenty-two practical questions are answered, each question and answer forming a chapter.

These questions include: What is this thing called power factor? What effect does poor power factor have on electrical equipment? How do I figure the amount of power-factor improvement I need? How do I determine the power factor of my

# Does turbine oil acidity keep you awake nights?

**NONPAREIL**
**TURBINE OIL**

ARE YOU periodically faced with the problem of determining how long you can run a fill of turbine oil before replacing it or treating it to reduce acidity? Do you have to watch turbine oil acidity constantly to avoid turbine deposits and poor oil demulsibility? If so, an oil that is *guaranteed* not to become excessively acid will end your worries—save time and labor too.

Nonpareil Turbine Oil is guaranteed not to exceed the low neutralization number of 0.15 mg KOH/gm for the life of your turbine. Actual oil records on all types of turbines over the past 18 years give ample proof that this guarantee assures low oil maintenance costs and trouble-free lubrication.

When you use Nonpareil, samples of the oil are tested by Standard Oil at regular intervals. These tests determine acidity, demulsibility, viscosity, and other significant facts about the condition of the oil. By these periodic checks and the guaranteed, low acidity you are relieved of all concern about your turbine oil. A Standard Oil Lubrication Engineer will explain fully this service and guarantee. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

**STANDARD OIL COMPANY (INDIANA)** STANDARD SERVICE

# NOW, GREASES THAT RESIST BOTH HEAT AND WATER

WERE YOU ever faced with the problem of lubricating bearings which operated under extremely wet conditions and, at the same time, were subjected to widely varying temperatures? If so, you probably had to choose between a high-temperature grease with poor resistance to water or a water-resistant lubricant with only fair resistance to heat.

Standard Oil's new Stanolith greases end all need for compromise. A lithium soap grease has unusual characteristics which conventional soda soap or lime soap greases cannot duplicate. Stanolith greases resist the washing action of water because they are insoluble in water and also are extremely adhesive. They resist heat because they are made from an extremely stable base oil and a high-melting point soap, and contain an oxidation inhibitor.

Where you have a heat-and-water problem or where costly machines demand the best possible lubrication, try Stanolith. A Standard Oil Lubrication Engineer will help to make a test. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

## Performance Characteristics of Stanolith Greases

- operate over a wide range of temperatures—have high dropping points.
- have excellent water resistance.
- have unusual mechanical stability—a minimum of oil evaporation and separation.
- contain effective oxidation inhibitors.
- are corrosion resistant.

Two grades of Stanolith Greases are available: No. 42—with a No. 1 consistency, and No. 57—with a No. 2 consistency.

**STANDARD OIL COMPANY (INDIANA)** STANDARD SERVICE

Above—Operation of Offset Herringbone Drift Eliminators in C. H. Wheeler Cooling Towers, described below.

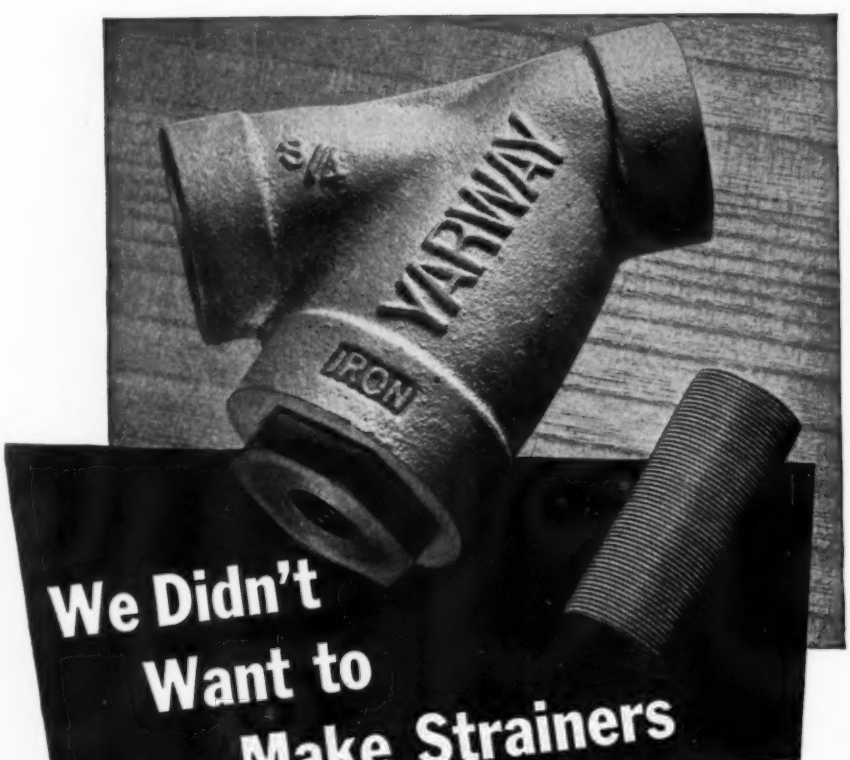
## DO YOU SUFFER COOLING TOWER MIST?

Have you ever felt a sudden mist on a clear day, near a water cooling tower? That mist is "drift loss" and to reduce this to an almost imperceptible minimum, Offset Herringbone Eliminators are located near the top of C. H. Wheeler Cooling Towers, as illustrated above. Air passing thru these two layers of blades changes direction and deposits moisture on the underneath side, which builds into drops that fall downward into the tower. This is only one of the many advantages of our 50 Years' Experience in building Induced Draft, Forced Draft and Natural Draft Cooling Towers. Bulletin No. 1044 shows various designs. Write for it today.

**C. H. WHEELER MFG. CO.**
1800 SEDGLEY AVENUE, PHILA. 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C. H. Wheeler

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA




We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.* Apparently a lot of other people were having "Strainer trouble" because the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

Cadmium Plated for protection against corrosion and for better appearance.

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Six standard sizes from ½" to 2" for pressures to 600 lb.

*See your Mill Supply House or write for Bulletin S-201*

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

plant? Does poor power factor increase my losses very much? In one chapter Joe asks 13 questions about synchronous motors, which are counted as only one of the 22. So 34 questions are really answered.

This unique book is well written and well illustrated; treatment is practical and in places amusing. The armature winder may wonder occasionally what it is all about, but it is recommended to everyone interested in power-factor problems.

### Servomechanisms

SERVOMECHANISM FUNDAMENTALS (1947) *By H Lauer, R Lesnick and L E Matson, all of Radio Corporation of America.* 277 *pp,* 6x9, *illust, cloth.* $3.50. *McGraw-Hill Book Co, Inc,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Though of a fundamental nature this book has been written principally for those who intend to design and build servomechanisms; it aims to satisfy the needs of engineering students and practicing engineers. Rather detailed derivations have been made of the basic properties of servocontrol devices and their relation to the physical principles that govern their operation.

Several examples, exercises and problems of a practical nature are given, together with the working formulas, curves and diagrams needed for their solution. The system of units has been selected to aid applications of formulas to field problems. Outlined are a few test procedures that will be helpful in checking design and performance of servosystems.

Transient analysis of elementary servomechanisms is particularly emphasized. Classical methods, rather than the more advanced operational calculus, are used to solve differential equations. To aid those readers whose facility with calc has grown rusty, the solutions are carried out in considerable detail.

### Steel Piping

ASTM SPECIFICATIONS FOR STEEL PIPING MATERIALS (*Dec* 1946 *compilation*) 307 *pp,* 6x9, *paper cover,* $3. *Reduced rates for orders in quantity. American Society for Testing Materials Headquarters,* 1916 *Race St, Philadelphia* 3, *Pa.*

Book includes 14 specifications covering various kinds of pipe, ranging from ordinary carbon steel to high-alloyed steels for high-temperature and high-pressure service. Thirteen specifications cover various boiler, superheater and miscellaneous tubes, including four standards on stainless tubing. Three specifications are on still tubes and a similar number pertain to heat-exchanger and condenser tubes. Five standards cover castings used in pipe installations, including valves, flanges and fittings, and there are four specifications on forgings and welding fittings. Three standards cover carbon and alloy-steel bolting. In addition, the book is made more complete by addition of *E*19-46 concerning austenite grain size in steels.

# NICKEL helps Worm Gearing Improve with use

*A Nickel bronze gear, teamed with a Nickel alloy steel worm, gives you heavy-duty gearing that actually improves with use.*

The long experience of one of the world's leading worm gear manufacturers, DeLaval Steam Turbine Company, clearly indicates that Nickel bronze gear teeth necessarily maintain their correct form, due to the regenerating action of the hardened steel worm. The latter, made of carburized Nickel-molybdenum steel, resists wear throughout years of use.

Nickel alloys such as these may meet the exacting demands of your particular equipment or production problems.

DeLaval standard worm and gear set built on 7.00″ shaft centers. The worm is made from case carburized Nickel molybdenum alloy steel and the gear is made of Nickel bronze.

After carburizing and direct quenching, Nickel alloy steel worms provide file hard cases supported by strong, tough cores. Machinable at high hardness levels, this steel also provides dependable uniformity.

The Nickel bronze gears, in addition to showing excellent resistance to wear and fatigue, have higher tensile strength than those of ordinary bronze.

EMBLEM OF INCO SERVICE
TRADE MARK

● Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK 5, N. Y.

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

## Pumps Q & A

(*Continued from page* 116)

may be connected to the suction line or manifold. Snifter valves are also used on moderate-pressure pumps to admit enough air to keep their discharge air chamber properly charged.

**Q 11—How is a vertical power pump installed?**

A—Most vertical power pumps built today are small enough to handle as an assembled unit except for the driver. Their foundations must be heavy enough to maintain the pump and its driver in alignment. For a belt drive provide a sliding-rail or tension base for the driver to adjust belt tension. Level the pump frame both ways, and support it firmly and evenly. A rigid concrete foundation is recommended except, possibly, for the smallest pumps. Support the frame at intervals and adjacent to all foundation bolts, leaving at least one-half inch of space for grouting. After the grout has set, tightly pull down the foundation bolts. Be sure that the frame is not distorted during any stage of the installation.

**Q 12—How is an inclosed crankcase horizontal power pump installed?**

A—In the smaller sizes with piston liquid ends, the pump may be handled like a vertical pump. Level the frame both ways, using the pinion shaft or finished surfaces on top of the frame in one direction and the cross-head guides in the other. Check the gear alignment to make sure the frame is not twisted. On larger pumps and those using forged-steel cylinders, locate the power ends first and then install the cylinders in proper alignment. Make sure that cylinders are level both ways and that plungers run true in the stuffing boxes for the whole stroke before installing packing.

**Q 13—How much backlash is required for pump gears?**

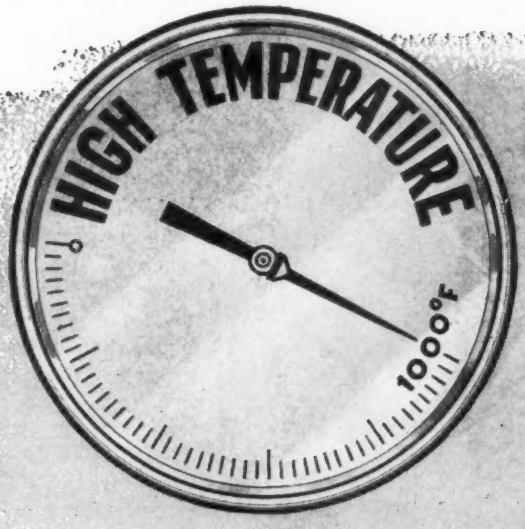
A—About 0.010 in. per inch of circular pitch, with a minimum of 0.005 to 0.006 in. for small gears. To check backlash, set a dial indicator against the flank of a pinion tooth and rock the pinion back and forth against the main gear.

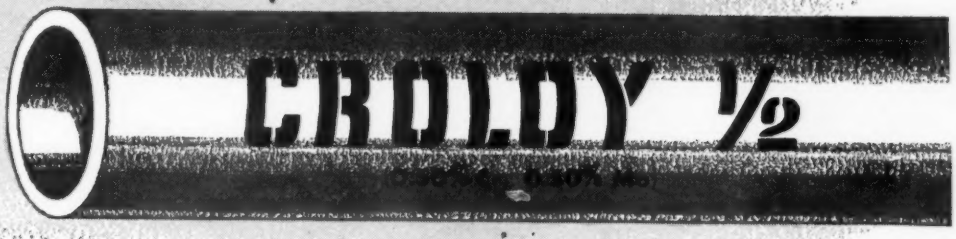
**Q 14—How should the alignment of gears and tooth bearing be checked?**

A—Level and parallel both shafts. If shafts are symmetrical on both sides of the gears, use a pin gage to check center distances at both ends of the shafts. If these are the same and both shafts are level, they are parallel. Check tooth bearing by lightly coating the pinion with prussian blue and rotating to

# new LOW-ALLOY steel

# for HIGH TEMPERATURE STEAM LINES




**BETTER** carbide stability and greater creep strength qualify this new member of the B&W Croloy family as a superior seamless steel piping for carrying steam at temperatures as high as 1000F. Possibility of sudden pipe failure due to carbide instability is therefore offset where Croloy ½ is used. Weldability and workability — bending, flanging, etc. — of Croloy ½ pipe compares with that of carbon and straight carbon-molybdenum steels.

Croloy ½ pipe is available in sizes up to 8⅝ inches O.D. It conforms fully to ASTM Specification A-280-46T.

**TENSILE PROPERTIES**

Tensile Strength, min. psi
55,000

Yield point, min. psi
30,000

TA-14045

Other B&W Products

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Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multi-fuel Burners • Refractories • Process Equipment.

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GENERAL OFFICES: BEAVER FALLS, PA.
PLANTS: BEAVER FALLS, PA. AND ALLIANCE, OHIO.

# Embrittlement Bugaboo Baffled!

## with De-ionized Water for your boiler feed

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# Boiler Feed-Water Treatment

Complete equipment for Chemical Processing: Purification of industrial wastes, Separation of Chemical Solutions, Purification of Chemical Solutions, Reclamation of Valuable Constituents

mark the contact with the gear teeth. Herringbone and spur gears may also be checked by inserting narrow strips of paper in meshing point at both ends of a tooth and noting the pressure on both strips. Where gears are accessible, thickness gages or feelers may be used to check both backlash and alignment.

**Q 15—What precautions should be taken when starting a new direct-acting steam pump?**

A—Blow and flush out steam and water lines so they are clean before connecting them to the pump. Clean pump of slushing compounds, pack and lubricate it. Open exhaust, suction and discharge valves. Be sure there is liquid available on the suction side of the pump. Drain condensate from steam line, open cylinder drains and crack steam valve to warm up pump cylinder. Gradually increase steam pressure until pump operates slowly, but do not close cylinder drains until most condensation has stopped. Increase load and speed gradually so operating details may be watched and necessary adjustments made.

**Q 16—What steps should be taken in starting a new power pump?**

A—Flush the water lines clean, pack and lubricate the pump as in Q 15. Turn pump through a full revolution by hand before applying power. Check rotation of driver. Horizontal pumps run "over" so that pressure is down on the crosshead. Open vertical pumps run so that the load is down on the pinion bearings. Inclosed vertical pumps are marked for the direction of rotation required by the lubricating system.

Open suction and discharge valves, prime pump if practicable, and open hand bypass if provided. After starting unit, run for a reasonable time at no load or with bypass open before gradually applying the load. Give pump time to warm up before applying full load; a new pump should have a further "run in" period. Check lubricating-system operation as soon as the unit starts; watch bearings and stuffing boxes for excessive heating as load is applied.

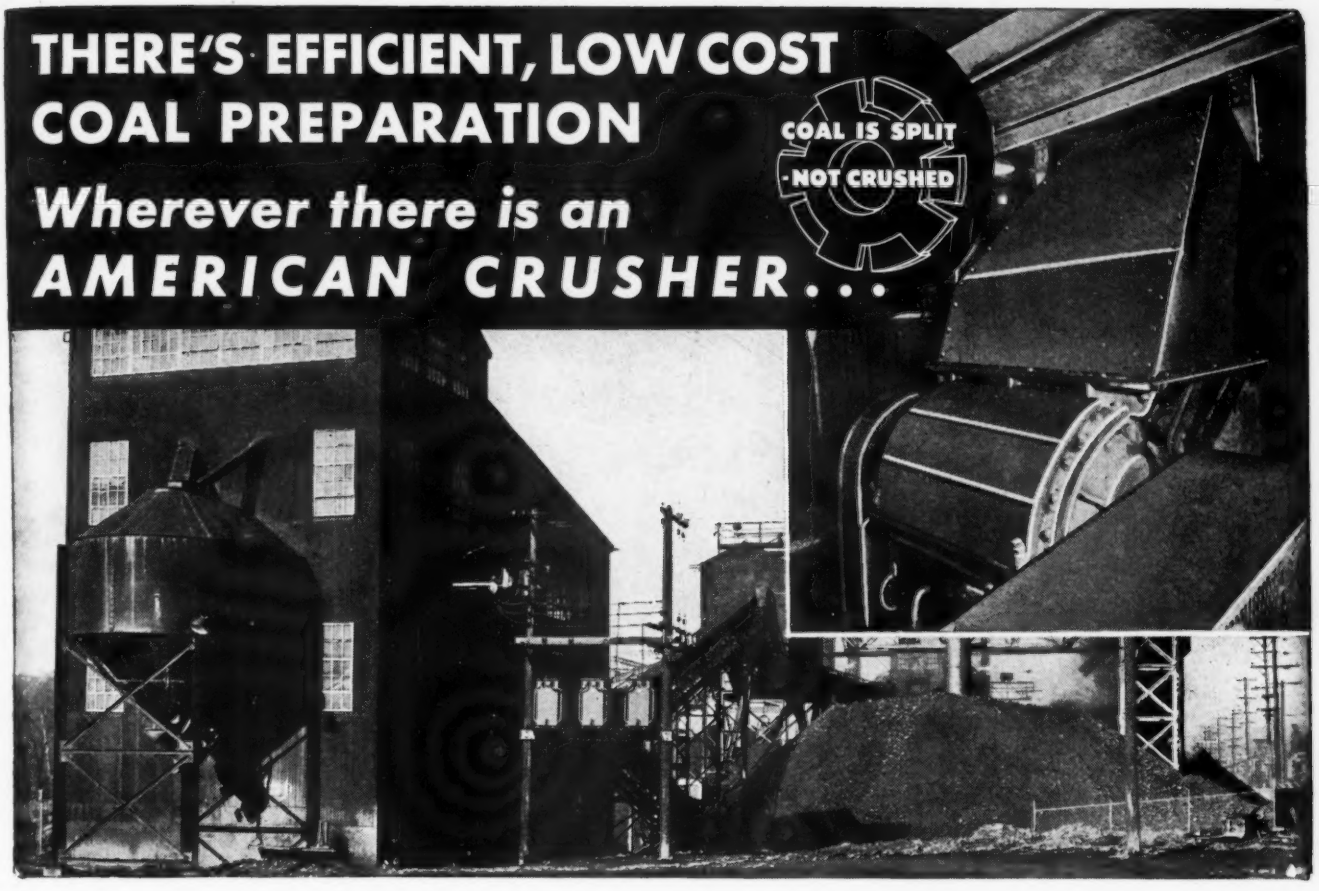
After the pump is running satisfactorily at rated pressure, check discharge relief-valve operation by throttling the outlet from the pump. It should begin to open at not more than 10 to 15% above rated pressure.

---

**United Fuel Gas Co.**, Charleston, W. Va., has filed with Federal Power Commission a request for authorization to construct and operate additional facilities in W. Va. to increase by about 41,000,000 cu ft per day capacity of its existing facilities for delivery of natural gas to Pittsburgh Group of Columbia Gas & Electric Corp System.

# THERE'S EFFICIENT, LOW COST COAL PREPARATION

## *Wherever there is an* AMERICAN CRUSHER...

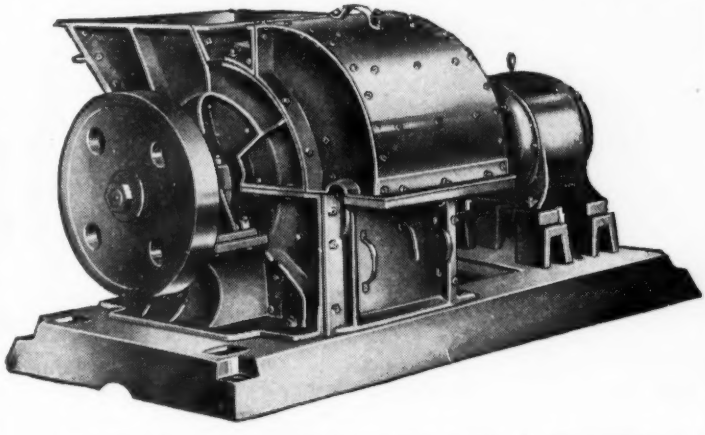



At the Windsor Power House Coal Co., Power, W. Va. preparation plant shown above, the American Rolling Ring Crusher Model 42S (in insert) is in daily operation reducing 5 x ¾" coal to—¾" at the rate of 230 TPH.

Throughout the country, in the many plants with American Crusher installations, you'll find efficient coal crushing resulting in efficient firing.

American Rolling Ring Crushers, with their patented shredder ring action which *splits coal instead of crushing it*, assures uniform sizing. Fines are controlled to a minimum or maximum and no oversize is passed. The crushed product is a constant yield of stoker or pulverizer size.

The *total operating cost* of Americans is *less than 1¢ per ton.*



The American "S" Crusher for power plants is a compact, complete crushing operation which is installed in minimum head room without extensive conversion and with no auxiliary crushing facilities.

There is an American Rolling Ring Crusher to fit your needs. Capacities up to 500 TPH.

Send for bulletin "Crushing Coal At Less Than 1c Per Ton"

**American PULVERIZER COMPANY**

*Originators and Manufacturers of Ring Crushers and Pulverizers*

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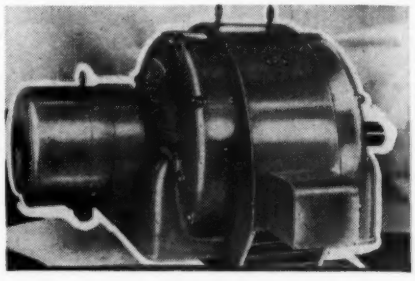
## New Equipment

(*Continued from page* 128)

is demanded. Hoist is available in ¼-, ½-, 1- and 2-ton standard capacities. **Dept P, Chisholm-Moore Hoist Corp, Tonawanda, N. Y.**



### Synchronous Motor

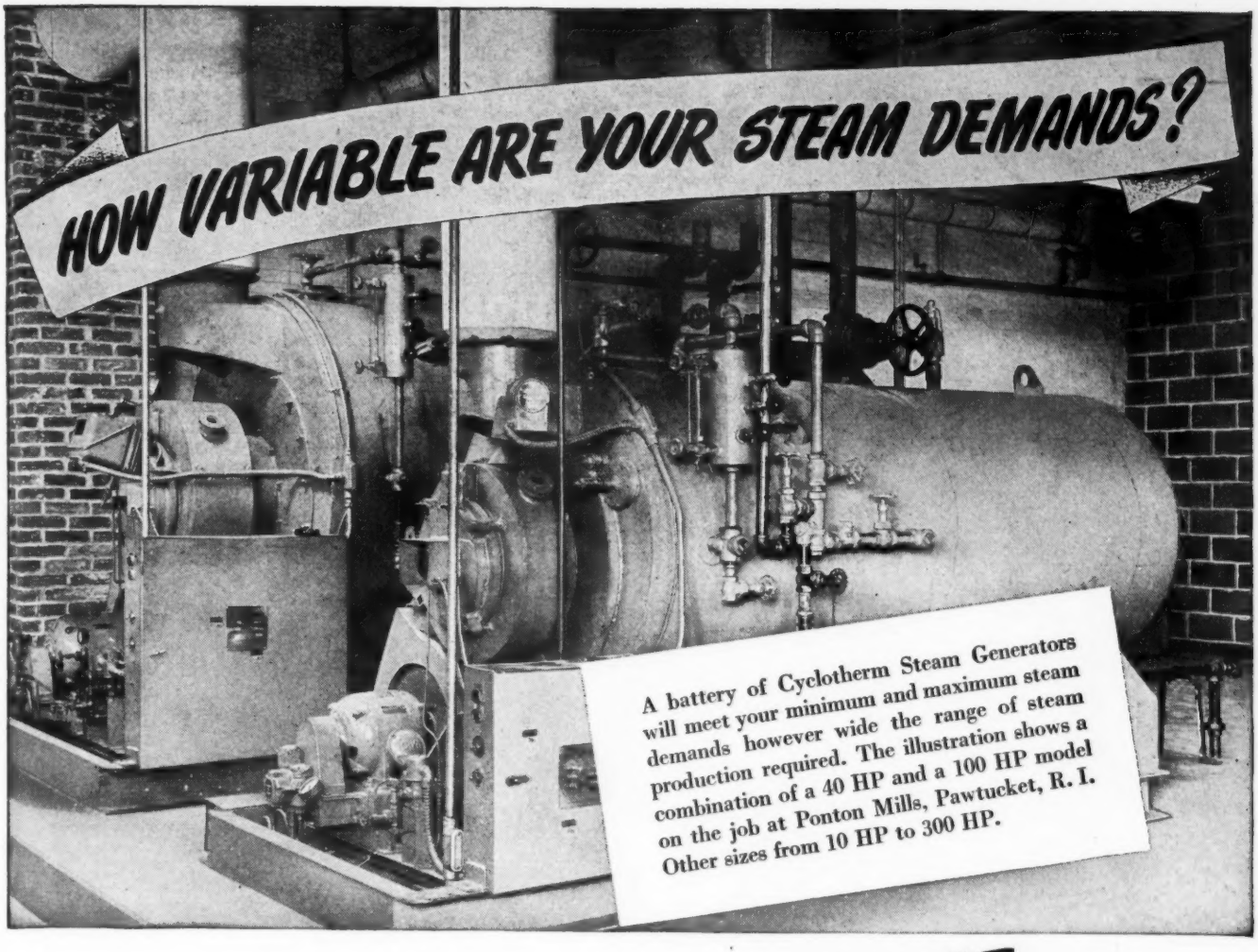
HEAVY-DUTY SYNCHRONOUS MOTOR for constant-speed drives up to 1000 hp are available in splashproof construction. These motors fulfill desire of paper mills, chemical plants, mining and milling operations and various pumping jobs. Stator frames in these motors are made of steel for extra strength without excessive weight.

Inspection and blowing out is simplified by access plates for speedy removal and replacement. Sealed bearings can be cleaned and refilled without motor disassembly. Double-end ventilation is provided by a blower on each end of rotor. Exciter ventilation is from a separate blower.

Units are available in unity or leading power factor with torque and kva requirements to suit the job. **Dept P, Electric Machinery Mfg Co, Minneapolis 13, Minn.**

### Induction Heater

MANUFACTURED IN UNITS of 10 kva for preheating and normalizing for welding, *Model UP* induction heater was developed for flexibility and adaptability to a wide-range of applications. This unit eliminates necessity of stocking a number of heaters in several capacities to handle large and small work. Individual units of 10 kva each may be stacked on the job to form groups of two and three units with capacities of 20 and 30 kva. Thus,


HOW VARIABLE ARE YOUR STEAM DEMANDS?
A battery of Cyclotherm Steam Generators will meet your minimum and maximum steam demands however wide the range of steam production required. The illustration shows a combination of a 40 HP and a 100 HP model on the job at Ponton Mills, Pawtucket, R. I. Other sizes from 10 HP to 300 HP.

## Cyclotherm steam production may be as *FLEXIBLE* as you want it without sacrificing efficiency or economy

**CHECK THESE POINTS THAT MEASURE VALUE AND YOU'LL SEE WHY CYCLOTHERM SHOULD BE YOUR 1st CHOICE**

- ☑ ***Simplified Design***—Cyclotherm's exclusive combustion method permits simplified overall design and 2 pass boiler construction. Burner and boiler engineered as an integral unit.
- ☑ ***Performance***—Cyclotherm provides steam automatically as you need it. Overall thermal efficiency will be not less than 80%.
- ☑ ***Economy of Operation***—Cyclotherm units may be fired with any liquid or gaseous fuel with maximum efficiency. Automatic modulation of flame on units 50 HP and up.
- ☑ ***Low Upkeep***—Unique combustion principle with 2 pass boiler assures longer life, fewer and easier inspections and "clean-outs."
- ☑ ***Initial Cost***—Cyclotherm units are low in cost; easy and inexpensive to install. Delivered ready to produce steam; require no special foundation.

## *IT'S YOUR BEST BUY!*

*Phone, wire or write for full information*

**CYCLOTHERM STEAM GENERATORS**

**CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 702, NEW YORK 4, N. Y.**

# Bulletin of the Month

## "BRIDGE-MEG" INSULATION and RESISTANCE TESTER

*REG. U. S. PAT. OFF.

DESIGNED and built to provide maintenance men with practically everything necessary for electrical resistance measurements from a fraction of an ohm up to 1000 megohms, the "Bridge-Meg" type of "Megger"* instrument combines in one compact, *portable* unit the facilities of a "Megger" Insulation Tester and a Wheatstone Bridge.

You'll find the "how and why" of the "Bridge-Meg" Insulation and Resistance Tester described fully within the profusely illustrated pages of this Bulletin of the Month. *Your* copy is waiting. No obligation, of course. Send *today* for Bulletin 21-60—PJ.

James G. **BIDDLE CO.**

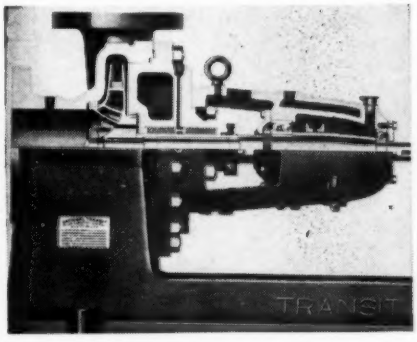
ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.


sufficient heater capacity is provided for preheating and normalizing welded joints on pipes of large diameter. The 30-kva group, for instance, is capable of preheating a 10-in. pipe joint to 1300 F in two hours.

Heating current and voltage output variations are controlled by a selector switch built into the unit. Controlling pyrometers and program controllers can be plugged into induction heater in two polarized receptacles for recording job temperatures and speed cycles. Polarized receptacles also provide for inter-connection of heaters into groups and for power supply to the unit.

Other uses are thawing large water pipes, testing high-current power bus connections, testing current transformers, supplying phantom loads for testing relays on power systems, resistance heating for brazing and soldering, shrink-fitting, heating for straightening, drying water-soaked rotors and stators, etc. **Dept P, Electric Arc, Inc, 112 Jelliff Ave, Newark 8, N. J.**




## Centrifugal Pump

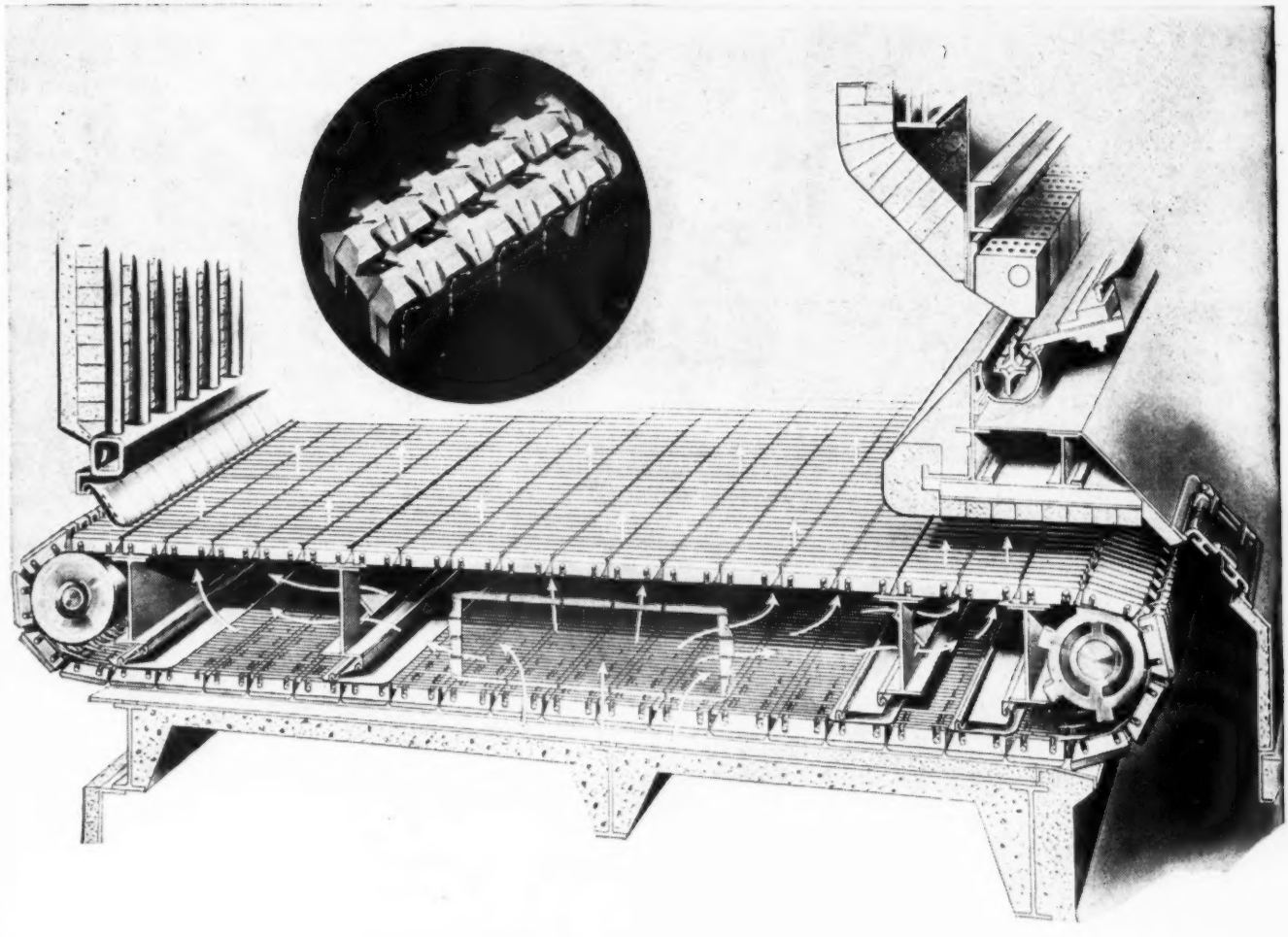
PROCESS CENTRIFUGAL PUMP serves where temperatures or pressures are high. Capacities range from 40 to 1500 gpm, heads from 40 to 1000 ft, and speeds 1750 to 4000 rpm. Allowable operating pressures for cast-iron construction, 600 psi at 100 F and 500 psi at 450 F, for steel 1000 psi at 100 F and 500 psi at 800 F. **Dept. P, National Transit Pump & Machine Co, Oil City, Pa.**

## Boring Tools

Comprehensive line of seven basic styles of standardized carbide-tipped boring tools, in four to six sizes each, is now available. Five of these styles represent additions to the previous standard stock line of round-shank square-end tools. The five new styles comprise two round-shank tools for 30- and 45-deg boring bars, in four sizes each, and three square-shank tools for 30-, 45- and 90-deg boring bars in six sizes each. All styles are carried in stock in grades for both steel cutting and boring of cast iron and other materials. All the new style tools (*Styles* 3, 4, 5, 6 and 7) have a primary clearance of 7 deg and a secondary clearance of 10 deg. All types and sizes are finish ground with a nose radius.

Diameters of the new round-shank tools (*Styles* 3 and 4) range $\frac{7}{16}$ to $\frac{1}{2}$ in. All of these styles are available with tips of

# Controlled Air—Complete Combustion



## *Bros Travl-Spred Stoker—Designed for Efficiency*

Economical combustion depends upon fuel feed, fuel burning, air control, and ash disposal. The *Bros* Travl-Spred stoker performs all these functions with highest efficiency.

Uniform fuel distribution over zoned burning areas, controlled air turbulance from the *Bros* tuyere type grate, and continuous ash discharge assure more steam output at less cost. Air from the forced draft fan is discharged to the center compartment of the stoker where most of the burning takes place and where, by damper arrangement, air is admitted at lesser pressure under complete control as to quantity, to the pre-burning section in the rear and to the burn-down zone in front.

Individual tuyere units, like that shown in insert, form the grate surface. Note how the air is accurately metered.

A compact hydraulic drive keeps the grate traveling in continuous forward motion, maintains the reliable operation of the *Bros* Travl-Spred stoker. Write for further information. Wm. *Bros* Boiler and Manufacturing Co., Minneapolis 14, Minnesota.

**BROS**

WATER TUBE, FIRE TUBE BOILERS • OVER FEED, UNDER FEED • HYDRAULIC-TRAVL-SPRED STOKERS

# OPERATIONS IMPROVED • STEAM COST REDUCED

● Stickle Equipment increases the efficiency of industrial processing operations, and reduces the overall cost of steam.

Stickle Valves supply accurate regulation of steam to meet minute-by-minute requirements of production. Stickle Traps keep production units free of condensate and air to maintain maximum production effectiveness. Stickle Differential Drainage and Boiler Return Systems save fuel by returning condensate to boilers, under pressure, with little loss of heat units. Stickle Open Coil Feed Water Heaters preheat raw makeup water with exhaust steam, otherwise wasted, and purify the boiler supply by eliminating scale-forming substances and oxygen.

Whether as individual units or in complete systems, Stickle Equipment is available in design for specific operating conditions and in capacity to fulfill operating requirements. Stickle Equipment is simple in construction, positive in operation, and dependable in service.

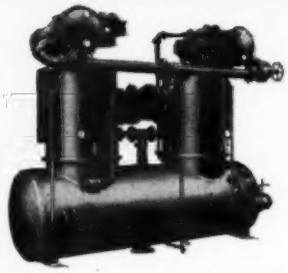
**ASK FOR BULLETINS**

The following bulletins supply mechanical information and engineering data on various items and lines of Stickle Steam Specialties: *Bulletin No. 117*—Stickle Open Coil Feed Water Heaters and Purifiers. *Bulletin No. 250*—Stickle Differential Drainage and Boiler Return Systems. *Bulletins No. 235 and No. 435*—Stickle Regulating and Reducing Valves. *Bulletin No. 501*—Stickle Temperature Control Valves. *Bulletins No. 115, No. 315, No. 415 and No. 515*—Stickle Open Float Steam Traps (state application for trap desired). *Bulletin No. 200*—Stickle Oil and Steam Separators.

**STICKLE STEAM SPECIALTIES COMPANY**
2265 Valley Avenue, INDIANAPOLIS 18, INDIANA

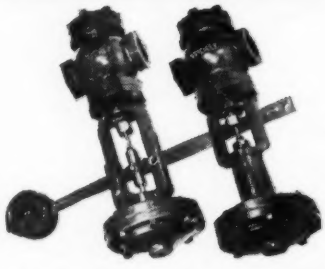
**STICKLE DRAINAGE AND CONTROL EQUIPMENT**

**STICKLE OPEN COIL FEED WATER HEATERS**



● Large heating capacity for given space. Deaerating and non-deaerating types. Cast iron or steel construction. Capacities from 3,000-lb. single heaters to 250,000-lb. dual heaters.

**STICKLE REGULATING and REDUCING VALVES**

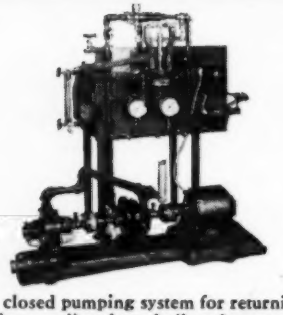


● Single-seated, balanced and Double-seated, semi-balanced self-contained valves. Semi-balanced pilot-operated valves. Standard and pilot-operated back pressure valves. Float valves. Desired sizes.

**STICKLE OPEN FLOAT STEAM TRAPS**

● Natural, positive action. Trouble-free operation—no friction, no sticking, no levers or hinges to get out of order. A design and size for practically any industrial application.

**STICKLE DIFFERENTIAL DRAINAGE and BOILER RETURN SYSTEM**

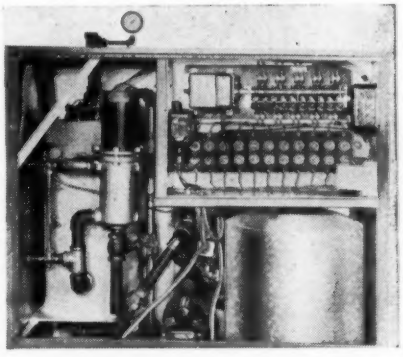


● A closed pumping system for returning condensate directly to boilers from processing units operating at high pressure. Saves fuel. Increases boiler capacity. Reduces pumping costs. Decreases maintenance on pumps, traps and valves.


two grades of Carboloy cemented carbide, *Grades* 883 and 831, the former for boring of cast-iron nonferrous and nonmetallic materials, and the latter for precision boring of steel.

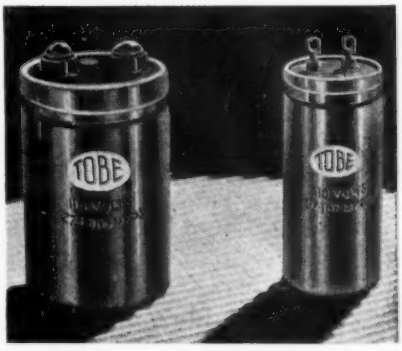
Square-shank boring tools (*Styles* 5, 6 and 7) are carried in stock in shank sizes ranging 5/16 to ¾ in. Sizes up to 1 in. are available in 883 and 831 grades, while the two larger sizes are carried in stock with 883 and 78 tips. The 78 grade is a steel-cutting grade for finishing and light roughing cuts.

*Styles* 1 and 2 square-end round-shank boring tools continue as formerly in shank diameters 5/16 to ¾ in. In addition, line includes round blanks for solid Carboloy boring tools from 3/32 to ¾ in. OD. These tools, as well as *Styles* 1 and 2, are available in *Grade* 78, 831, 883 and 905. **Dept P, Carboloy Co, Detroit, Mich.**



## Electric Steam Generator

PACKAGED, electric steam generators require 6 sq ft floor space for units capable of delivering steam at 100 psi, and in capacities from about 50 to 150 lb per hr. Efficiency claimed by the manufacturer for the *Vap-O-Lec* is 98%. Auxiliaries accompanying the steam generator include a pump, receiver, modulating controls, pressurestat, solenoid valve for boiler makeup system, and control for boiler-water level. **Dept P, Cronholm Mfg Co, 3500 S W Hawthorne Ave, Portland, Ore.**




## Motor-Starting Capacitors

THESE ELECTROLYTIC CAPACITORS start circuits of 110- and 220-v ac motors. For the 110-v rating, capacitors are available from 20 to 420 mf, and for the 220-v rating they range from 20 to 60 mf. Operating temperature range is 76 to 185 F.

For convenient incorporation in motor

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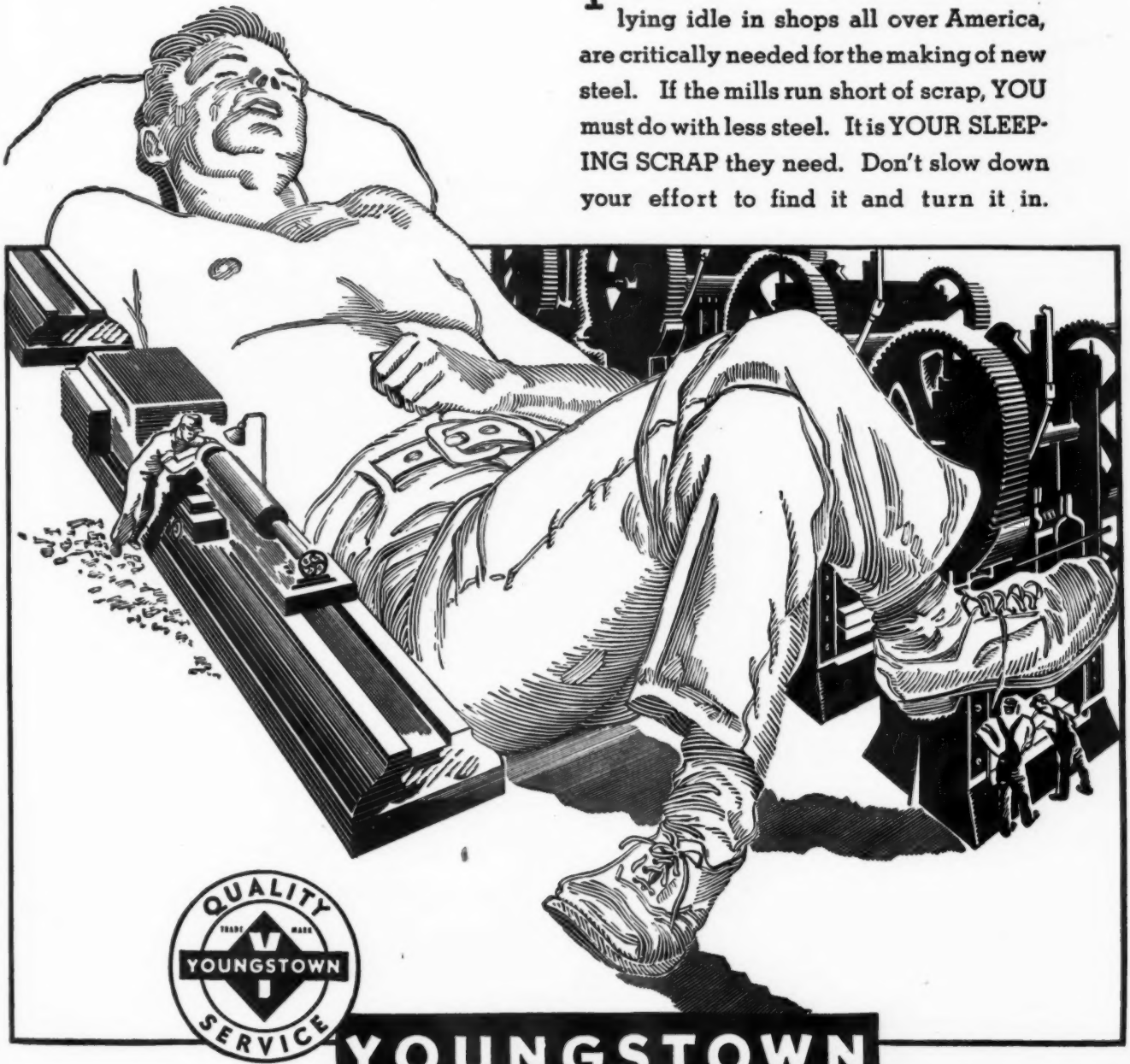
## Put this giant to work at once, making STEEL

THE millions of tons of dormant scrap, lying idle in shops all over America, are critically needed for the making of new steel. If the mills run short of scrap, YOU must do with less steel. It is YOUR SLEEPING SCRAP they need. Don't slow down your effort to find it and turn it in.



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# SAVE SUPERVISION

## in fitting

# PRECISION PARTS

YOU PROBABLY KNOW Laminum shims as assembly time savers. But have you overlooked the fact that in fitting machine parts by peeling these precision laminations, considerably less supervision is required. You have the certainty of uniform accuracy . . . with no spoilage. Your request for data invited.

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Laminated Shim Company, Incorporated

61 Union Street • Glenbrook, Conn.

LAMINUM

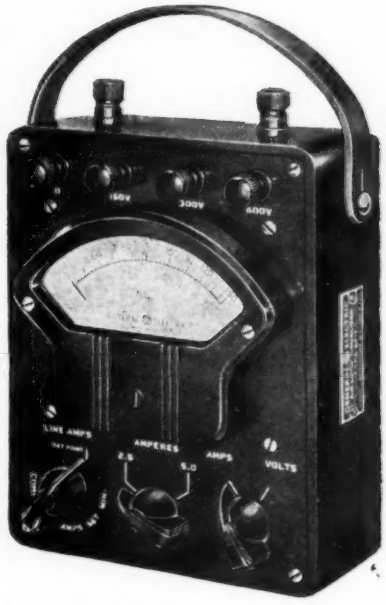
THE SOLID SHIM THAT peels FOR ADJUSTMENT

2221


housing, motor-starting units are provided in round metal cases in three sizes from 1¾ to 2 in. dia. The 2-in. dia case is furnished with screw terminals, and 1¾-in. case has solder lugs. Standard insulating tubes and mounting hardware for all sizes are available. **Dept P, Tobe Deutschmann Corp, Canton, Mass.**

## Fluorescent Lighting

HINGED GLASS DIFFUSERS swing open under pull of a servicing tool equipped with a gripper for seizing the glass panels. This hinge action allows dusting, cleaning or relamping from floor level. *Aristolites* are available in assemblies of 2, 3, or 4-40 watt sizes and can be arranged individually, in continuous rows or mounted directly to ceiling. **Dept P, Edwin F. Guth Co, 2615 Washington Ave, St Louis, Mo.**




## AC Load Visualizer

CONSISTING OF MANY INSTRUMENTS in one, AF-1 ac load visualizer is a lightweight, low-cost analyzer for single-phase and balanced polyphase systems. Besides serving as a standard 0-2.5/5 amp ammeter and a 0-150/300/600 v voltmeter, this instrument serves with the calculator furnished to determine watts, vars, volt-amperes and power factor for load surveys, induction motor tests, reactive power studies and power factor checks on power and lighting circuits.

Instrument has an iron-vane moving element and separate field winding for voltage and current. Current winding is electrically insulated from imposed voltage by an internal dc transformer. Current and voltage terminals of the AF-1 are energized simultaneously from the line or through instrument transformers to extend the range. Three selector knobs placed opposite connection terminals control instrument operation. The external current circuit is not interrupted by operation of any of the control knobs. Instrument is magnetically damped, fully shielded and equipped with an external zero set. **Dept P, General Electric Co, Schenectady 5, N. Y.**

# WALWORTH

# *Pressure-Seal Valves*

**The greatest improvement in high-pressure, high-temperature valve design**

WHY?

Because the fundamental principle of the design of the Walworth Pressure-Seal Valve is such that the internal pressure makes the body-to-bonnet joint tight. This tightness extends over the range of all practical conditions, including "carry-over", sudden changes of temperature, and sudden changes of pressure.

The body-to-bonnet joint is easily disassembled and assembled in a minimum of time, reducing the period the pipe line is out of service.

Valve maintenance is reduced to a minimum.

These valves have a semi-flexible disc which compensates for changes in the body shape due to temperature and pressure variations.

An improved guide extends over the entire travel of the disc, making the Walworth Pressure-Seal Valve easier to open and close.

Valve ports and guides are designed to give streamline flow.

The strength of Walworth Pressure-Seal Valves is greater than that of previous designs, even though the weight is reduced approximately 50 per cent.

Walworth Pressure-Seal Valves are now available in the following sizes: Series 900 — 3" and larger; Series 1500 — 1" and larger.

## LOOK AT THESE ADVANTAGES

1. BONNET TIGHTNESS
2. NO BONNET BOLTS OR WELDS
3. IMPROVED YOKE DESIGN
4. EASILY AND QUICKLY ASSEMBLED
5. EASILY AND QUICKLY DISASSEMBLED
6. DISC TIGHTNESS
7. IMPROVED GUIDE
8. STREAMLINE FLOW DESIGN
9. EASY TO CLOSE
10. EASY TO OPEN
11. VALVE STRONGER
12. WEIGHT REDUCED
13. SPACE REDUCED

# WALWORTH

**valves and fittings**

60 EAST 42nd ST., NEW YORK 17, N. Y.

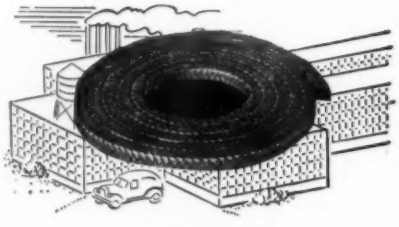
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

# WOULD ONE OF THESE *Packings* END ONE OF YOUR PACKING PROBLEMS?

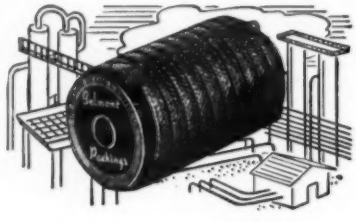
As examples of the extra service you get from Belmont Packings, here are three packings built with special features to give you better sealing and longer life. And for *any* steam, water, oil, gas, air, acid, alkali or ammonia service . . . tell your distributor: "Belmont".

**Extra sensitive to gland pressure.** Belmont 2 Diagonal Wedge Expansion Packing has sliding rubber and duck diagonal wedges incased on three sides with rubber and duck channel. For reciprocating rods and plungers (especially when worn) working against hot and cold water, steam up to 340°F., ammonia.

**For rotating shafts.** Every strand of asbestos yarn in Belmont 754-P Centrifugal and Rotary Pump Packing is thoroughly lubricated and graphited, resulting in a packing that will keep pliable for long, economical service.



**For gasoline and other petroleum distillates.** Belmont 6100 is made of a high-grade asbestos yarn, firmly braided, each strand thoroughly impregnated with a special compound to retain softness and essential sealing qualities when applied against volatile distillates.



**There is a Belmont Packing for Every Service**

Belmont distributors are located in every large industrial center, ready to give you prompt delivery from local stocks.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

IN THE BLUE-AND-ORANGE BOX

6 New Folders
Write us for new folders on Belmont Centrifugal and Rotary Pump Packings, Flax Packings, Hollow Center Packings, Oil and Gasoline Packings, Rod Packings, Sheet Packings.

THE BELMONT PACKING AND RUBBER CO.

Butler and Sepviva Streets

Philadelphia 37, Pa.


## POWER NEWS

(*Continued from page* 138)

some of the German equipment seemed needlessly clumsy and expensive. German conditions indicated coal or coke as the commercial raw material. The synthesis gas, however, can be made from any material that contains carbon and is combustible.

In this country, natural gas is now simpler and cheaper to use than coal and is generally accepted as the immediate commercial material for the American synthesis process. In most American fields, natural gas consists of 85% or more of the light, odorless and highly inflammable gas known as methane ($CH_4$) the lightest of all hydrocarbons. In one method of synthesis, it is mixed with oxygen and partly burned at high temperature in a generator lined with firebrick.

Therefore, instead of mixing two volumes of oxygen with one of methane as complete combustion requires, the ratio is reversed and two volumes of methane are mixed with one volume of oxygen to produce incomplete combustion. This reduced feed of oxygen enables the one atom of carbon in the methane molecule to combine with oxygen to form carbon monoxide and thus liberates four atoms of hydrogen. Resulting "water gas" mixture of carbon monoxide and hydrogen is synthesis gas.

### PURIFIED SYNTHESIS GAS

In actual practice, slightly more than one volume of oxygen for every two volumes of methane is admitted to the generator to raise combustion temperature to desired level. This excess of oxygen produces a little carbon dioxide and water vapor. It may be necessary to cleanse the synthesis gas of sulphur that occurs in some natural gases, for the catalyst used in the final stage of the process is highly sensitive to sulphur poisoning, which renders it inactive. The purified synthesis gas is cooled and run to synthesis reactors.

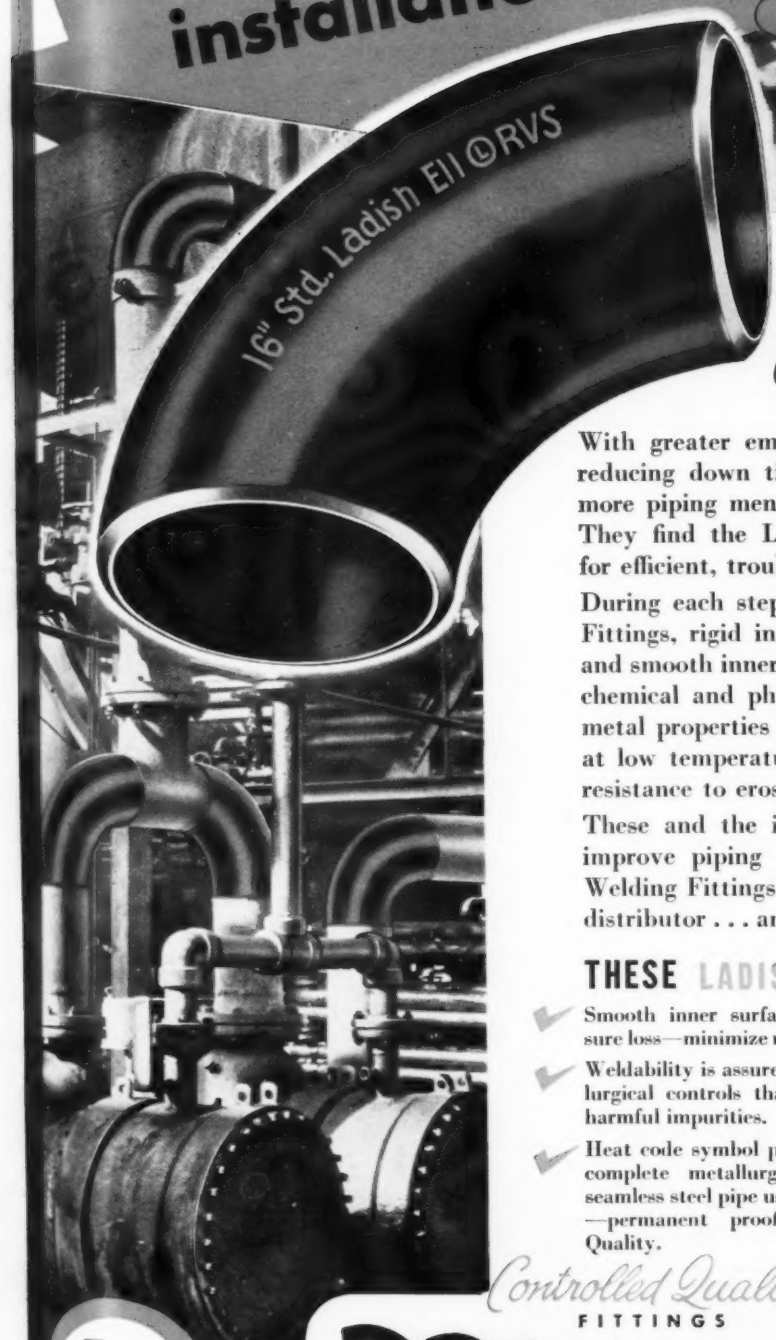
Temperature and pressure are carefully controlled in the reactors. In fact the enormous heat developed during the synthesis reaction was one of the most difficult problems that Fischer and Tropsch had to solve in Germany. Their solution took form of many relatively small reactors, each with a large cooling surface of water tubes and with the small pellets of the catalyst lying between the tubes.

By introducing its "fluid" (fine dust)

(*Continued on page* 172)

# Safeguarding

## another new piping installation with




## LADISH Seamless Welding Fittings

With greater emphasis being placed on increasing production . . . reducing down time . . . and cutting maintenance costs, more and more piping men are specifying Ladish Seamless Welding Fittings. They find the Ladish Ⓛ trademark on fittings good insurance for efficient, trouble-free piping operation.

During each step in the manufacture of Ladish Seamless Welding Fittings, rigid inspection procedures assure uniform wall thickness and smooth inner surfaces, free of irregularities. Through exhaustive chemical and physical tests, Ladish metallurgists carefully control metal properties to provide an added protection against brittleness at low temperature, distortion at high temperature, and increased resistance to erosion and corrosion.

These and the important advantages listed below are helping to improve piping performance. When you specify Ladish Seamless Welding Fittings, you get prompt, efficient service from your Ladish distributor . . . and a full measure of dependability from your piping.

### THESE LADISH FEATURES ASSURE DEPENDABILITY

- Smooth inner surfaces reduce pressure loss—minimize resistance to flow.
- Weldability is assured by rigid metallurgical controls that guard against harmful impurities.
- Heat code symbol provides access to complete metallurgical analysis of seamless steel pipe used in each fitting —permanent proof of Controlled Quality.
- Accurate included angles and dimensions permit fabrication of large complicated sections.
- Full effective radii and unrestricted circularity improve flow efficiency.

*Controlled Quality* FITTINGS

**LADISH CO.**

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

*DISTRICT OFFICES:*
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles

**SEND TODAY FOR THIS DIMENSIONAL DATA FOLDER**

LADISH CO.
Dept. P-6
Cudahy, Wisconsin

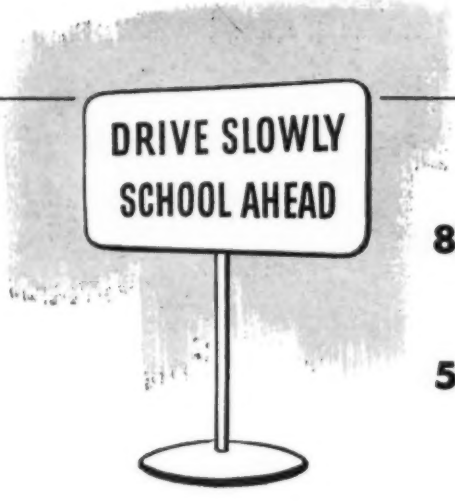
Please send me the handy 10-page data folder giving dimensions, weights and part numbers of Ladish Seamless Welding Fittings.

Name.....
Title.....
Company.....
Address.....
City.....Zone...State.....

TO MARK PROGRESS

# Only Sloan

## *can say this:*




**83% OF ALL SCHOOL SYSTEMS* ARE SLOAN EQUIPPED—**

**54% OF ALL SCHOOL SYSTEMS ARE EXCLUSIVELY SLOAN!**

There are several reasons for Sloan's pre-eminence. For one thing, maintenance costs are reported as low as ¼ of 1c per Valve *per year.* Then too, Sloan Flush Valves save water; they protect public health by preventing back syphonage; they can now be whisper quiet; they have unlimited life—yet cost no more. That is why more Sloan Flush Valves are sold than all other makes combined.

**SLOAN VALVE COMPANY • 4300 W. Lake St., Chicago, Ill.**

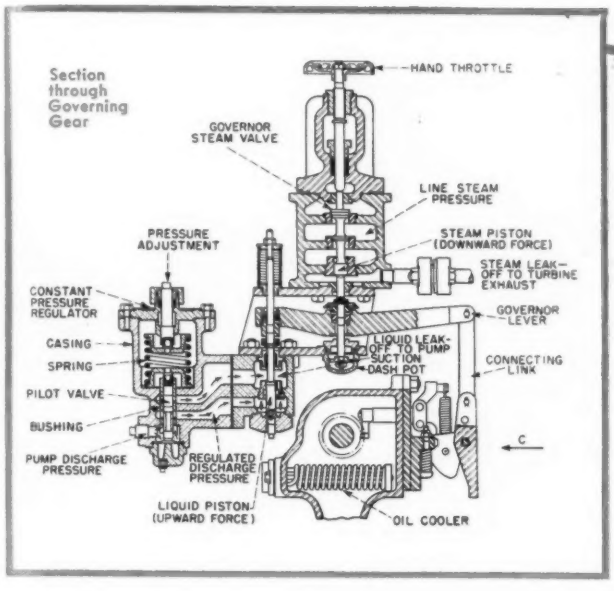
**In cities of 25,000 population and over.*

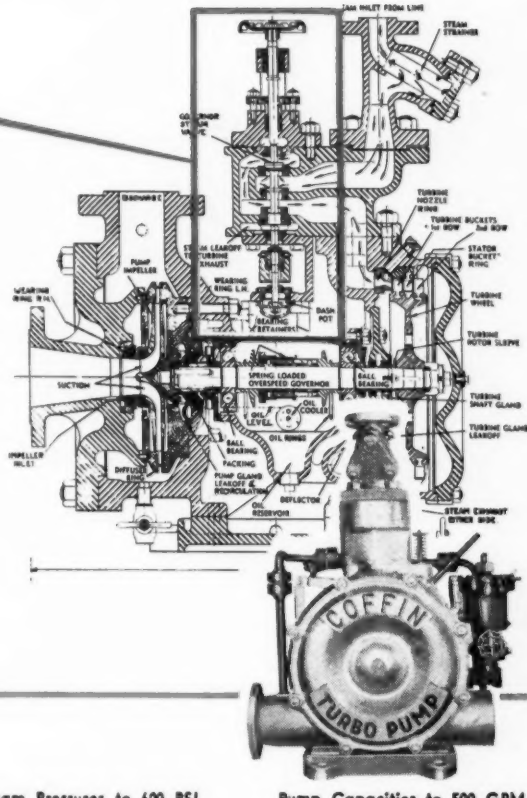
sloan *Flush* valves

# COFFIN TURBO PUMPS

## HIGH SPEED • SINGLE STAGE

# 4-*Wide Range exact* pressure governing




**The Coffin Governing Gear is a powerful hydraulic relay turbine governor responsive to pump discharge pressure. Diaphragms and bellows are not used. The hard stainless steel piston elements give instant and accurate response to pressure impulses, maintaining steady discharge pressure without "hunting" or necessity for adjustable damping. Sediment bearing and scale depositing liquids give rise to no operating difficulty. Activity prevents the emergency governors from becoming stuck open.**

*Standardized Boiler Feed Units for:*

Steam Pressures to 600 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

### UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine results in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating date.

***Representatives in Principal Cities***

INDUSTRIAL • RAILROAD • COFFIN • MARINE • PRODUCTS

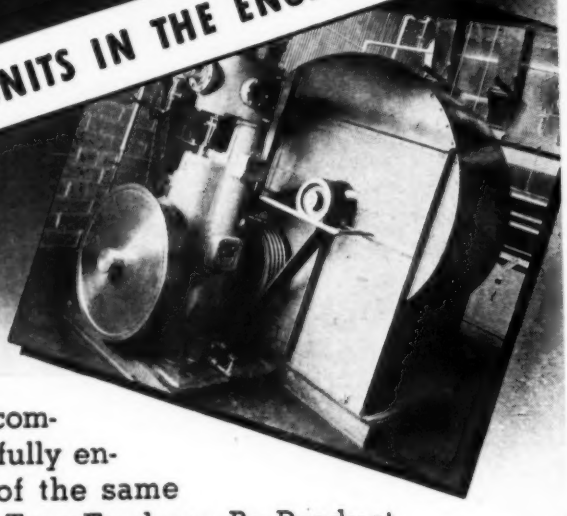
**The J.S.COFFIN, JR., CO. 326 South Dean St. ENGLEWOOD, N.J.**

TROY-ENGBERG STEAM ENGINE

By-Product Power

1 POWER for your stokers, generators, pumps, compressors

2 HEAT UNITS IN THE ENGINE EXHAUST



And both accomplished by skillfully engineered use of the same steam. This is Troy-Engberg By-Product Power at work.

Use the modern Troy-Engberg Steam Engine to drive stokers, blowers, fans, compressors, mixers, generators and pumps—THEN use the exhaust from the engine for your processing or heating, or both.

Cut Power Costs by putting your steam fully to WORK. Write us for detailed information on applying Troy-Engberg By-Product Power to your plant.

Send for Bulletin 306

TROY ENGINE & MACHINE COMPANY

*Established 1870*

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TROY-ENGBERG

STEAM ENGINES • GENERATING SETS • GENERATORS

type of catalyst in place of the pellet catalyst of the German process, Standard Oil Development Co, the research affiliate of Standard Oil Co (New Jersey), has reduced this layout of many reactors to a few reactors whose cooling surface is less than 1% of that of the Fischer-Tropsch process. The cooling tubes serve as a boiler in the production of steam for power purposes.

The finely powdered fluid catalyst lies in a deep dense mass, filling the space around cooling tubes in the reactors. The synthesis gas, forced in at bottom of each reactor, immediately begins to generate heat, the fluid catalyst conveying the heat throughout the reactor.

In its rise through the catalyst, the simple CO and $H_2$ of the synthesis gas are re-aligned into a range of hydrocarbons varying in molecular complexity from the light $CH_4$ to the heavier complex molecules of diesel fuel.

The primary products are obtained from the gas-vapor mixture that is led away from the reactor. Among finished products are high-quality motor gasoline and lesser amounts of diesel fuel, alcohols and acids, and some light hydrocarbon gases.

### FUELS OF THE FUTURE PROGRAM

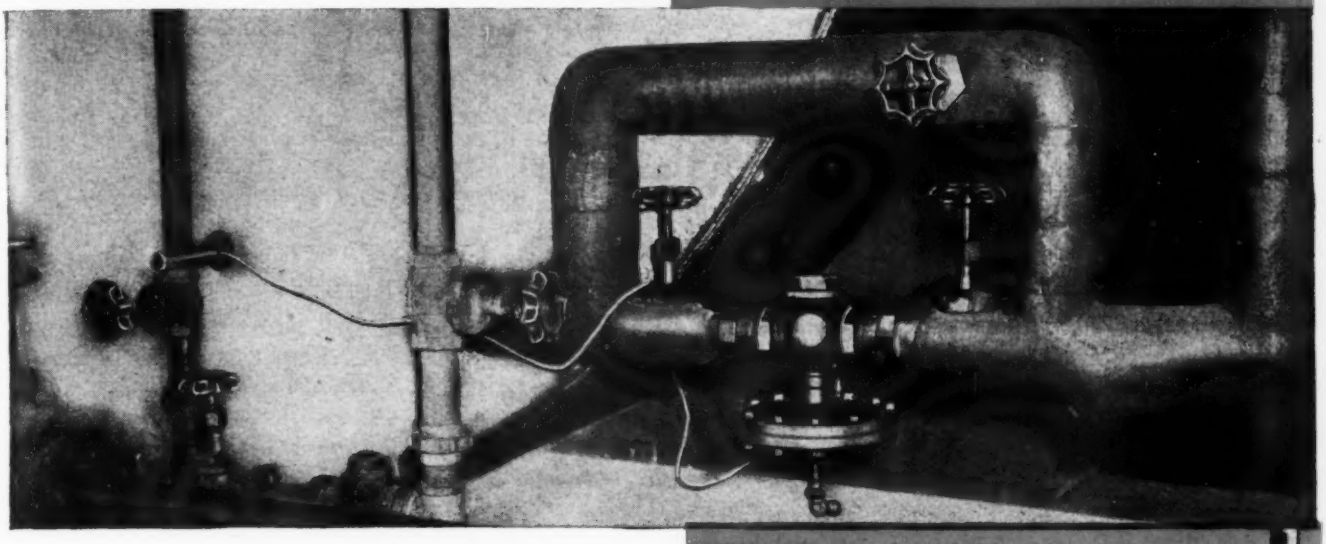
Standard Oil Development Co held a program called *Fuels of the Future* that included a tour of the Esso Laboratories, Linden, N. J., on April 16. The synthetic-fuels, gas-turbine and combustion laboratories were a few of the units visited.

In the synthetic-fuels laboratory, experimental work is being conducted on production of synthetic liquid fuels from mixtures of carbon monoxide and hydrogen gases. An important problem is discovering effective catalysts, and much of the experimental work lies along the lines of evaluating potential catalysts. Those showing promise in these preliminary tests are subsequently studied in larger units where conditions existing in commercial units are more nearly approached. The catalyst is in powdered form in these larger pilot-plant units, using the fluidized technique that has been so successful in the fluid catalytic cracking process.

To assist in developing fuels for jet turbine engines and to guide engine manufacturers in their design, it is important to establish the effect of fuel quality on engine performance. To this end, Standard Oil Development Co has been carrying out experiments in their gas-turbine laboratory on a full-scale single-tube combustor, taken from one of the latest design multicombustor aviation jet engines.

In their combustion laboratory Stand-

# *Making Oil Run* AT ZERO TEMPERATURES



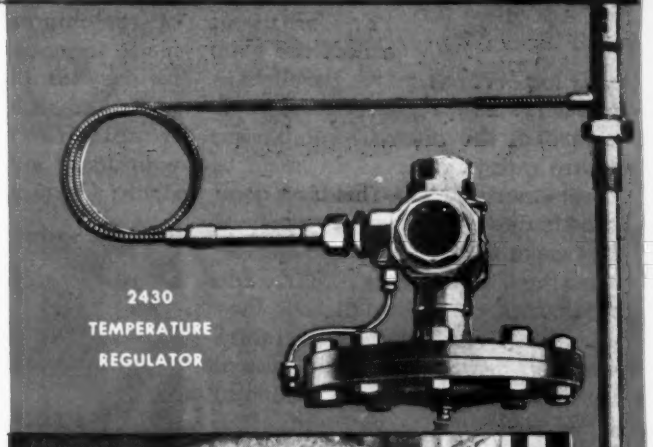
Outdoor blending tanks lead directly to processing rooms in this Pittsburgh plant which makes highly special lubricating greases. "Temperature is one thing we have never worried about since we began installing Sarco 2430 Regulators two years ago," says the Mechanical Superintendent. It's another case where too much heat would ruin the product —too little would shut down the plant.

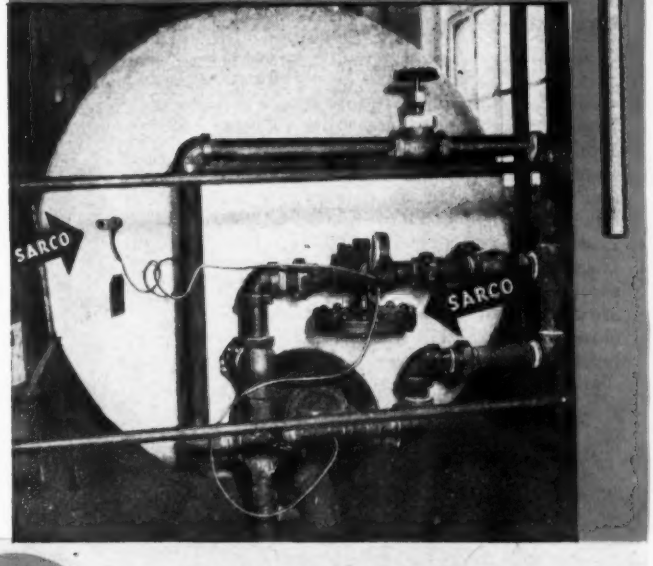
This regulator is also frequently used on hot water storage tanks—as shown at the right.

Other forms of Sarco Controls are available for steam equipment in process work, air in rooms or ducts, cooling of jackets and condensers, and the blending of hot and cold water, brine or other liquids.

The correct combination of Sarco Steam Traps and temperature controls can be determined by the nearest Sarco Representative—a specialist in industrial and heating applications.

137




**SARCO** SAVES STEAM

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*Represented in Principal Cities*
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SARCO CANADA, LTD., TORONTO 1, ONTARIO

THE PACKING for EVERY PURPOSE

Stops Leaks Prevents Scoring

ALLPAX

This universal packing—consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphic scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc., where temperatures do not exceed 600° F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

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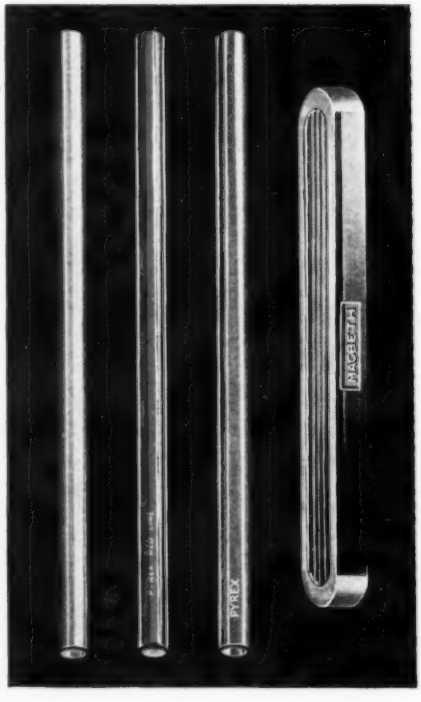
THE ALLPAX CO., INC., MAMARONECK, N. Y.

**For want of a gauge glass production was lost...**

The old adage, "For want of a nail the shoe was lost"... has many parallels in industry. Every plant manager is aware of the necessity of having spare gauge glasses on hand to meet emergencies. • This is a good time to check up on your supply... but make sure your gauge glasses bear the CORNING or PYREX trade mark. Made of special glasses, they are highly resistant to temperature changes and the corrosive action of steam and hot water. Their smooth, hard surfaces lessen the possibility of scratching and pitting. They are made to machine drawn accuracy for easy installation. • All of these factors mean long, economical and trouble-free performance. Call your local mill supply dealer. He stocks Corning products for you.

**Corning Gauge Glasses for Every Service**

If more than ordinary visibility is desired, specify PYREX Red Line Gauge Glasses. • For general high pressure duty, PYREX High Pressure Gauge Glasses give you long service under the most severe operating conditions. • Where moderate temperatures and initial costs are the determining factors, CORNING Standard Gauge Glasses are recommended. • MACBETH Flat Gauge Glasses are designed for high steam pressures. Two types are available; *plain*, which are used in pairs with the water column enclosed between the two glasses, and *reflex* (made with vertical prisms), which are used singly with prisms adjacent to water column.

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PYREX GAUGE GLASSES

BRAND

TECHNICAL PRODUCTS DIVISION: GAUGE GLASSES • GLASS PIPE • LIGHTINGWARE SIGNALWARE • LABORATORY GLASSWARE • OPTICAL GLASS • GLASS COMPONENTS

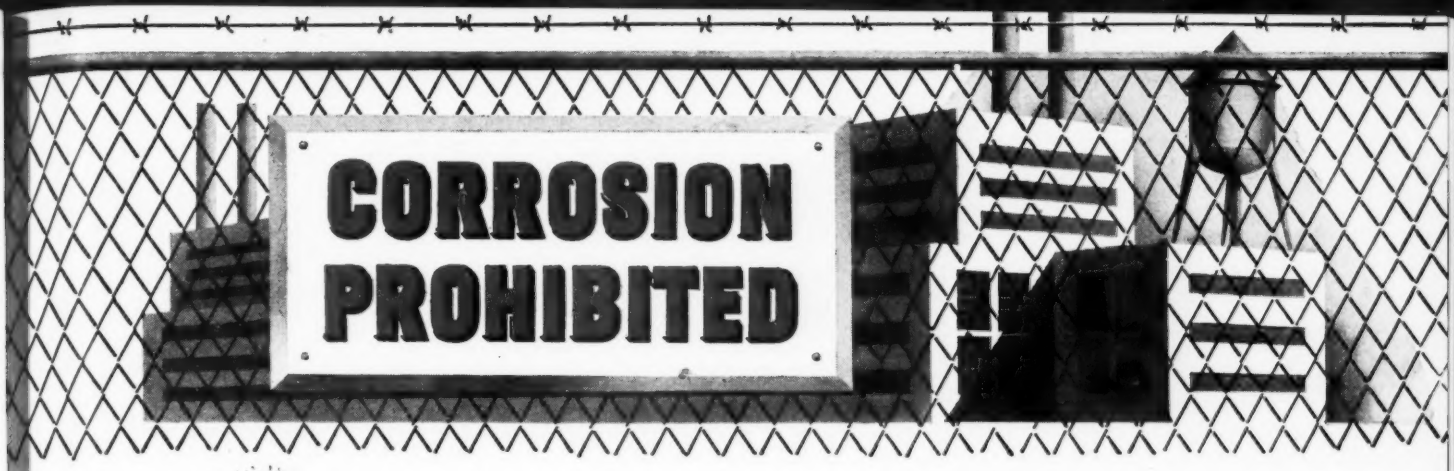
ard Oil is engaged in intensive studies on behavior of fuels during the combustion process. One particular phase of the work operates under contract with Navy Dept, Office of Naval Research. Combustion studies are made of: (1) measurements of flame velocities that may indicate rate at which fuel releases its energy (2) effect of fuel quality, jet velocity, etc, on flame length (3) chemistry of combustion through spectroscopic study of flame (4) methods of accurately measuring flame temperatures using the sodium line reversal technique.

### DIESEL ENGINE FUEL

*Fuels for Reciprocating Automotive and Aircraft Engines* was discussed by Albert J Blackwood, assistant director, research div, Esso Laboratories, at *Fuels of the Future* program. He emphasized that with increasing use of high-speed diesels, there has been a trend toward seeking fuels of exceptionally high cetane numbers. Diesel engines must be of heavy construction to withstand high pressures developed with present fuels. If fuels could be found that would not require high pressures now needed for ignition, engine weight could be reduced and smoother operation would lessen maintenance and increase engine life. Research is going forward to discover methods of making such fuels. One way would be by use of ignition promoters, substances that could be added to the fuel in small quantities, like tetraethyl lead in gasoline, to effect improved burning quality. Although moderately successful ignition promoters have been found, it is still hoped that some superior compound of outstanding properties may yet be discovered.

Mr Blackwood stated that the growing commercial application of the diesel engine may materially affect nature of future diesel fuel. Whereas highest-grade diesel fuel has usually been straight-run distillate from paraffin-base crude oil, an excessive future demand for fuel may make it economically desirable to manufacture it from other sources, incorporating required properties by use of special additives.

Philetus H Holt, assistant director, research div, Esso Laboratories, mentioned in his talk on *Gas Turbines and Jet-Propulsion Fuels* that heat is released in combustion chamber of the turbine jet engine at a rate of about 20,000,000 Btu per hr per cu ft of combustion zone. This compares with a rate of 20,000 to 40,000 Btu per cu ft per hr in ordinary power-station boiler furnaces. This concentrated energy release is accomplished with a freedom from




## PERMUTIT* DEAERATING HEATERS REMOVE ALL OXYGEN AND FREE $CO_2$ FROM FEEDWATER

Corrosion is banned! Boilers, auxiliaries, and steam lines are kept rust-free, in top operating condition, year after year with Permutit Deaerating Heaters.

Permutit Deaerating Heaters are guaranteed to remove all oxygen (Winkler test) and free $CO_2$ from feedwater. Spraying the feedwater through steam removes most of the oxygen and free $CO_2$; deaeration is completed when the preheated water is boiled briskly in the steam scrubber. Bled or exhaust steam is utilized for the entire operation!

Free Advisory Service! Permutit makes every type of water-conditioning equipment . . . its technical staff will be glad to cooperate with you and your consultants to design equipment that will fit your individual plant requirements. Write for free, informative booklets, to The Permutit Company, Dept. P6, 330 W. 42nd St., New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

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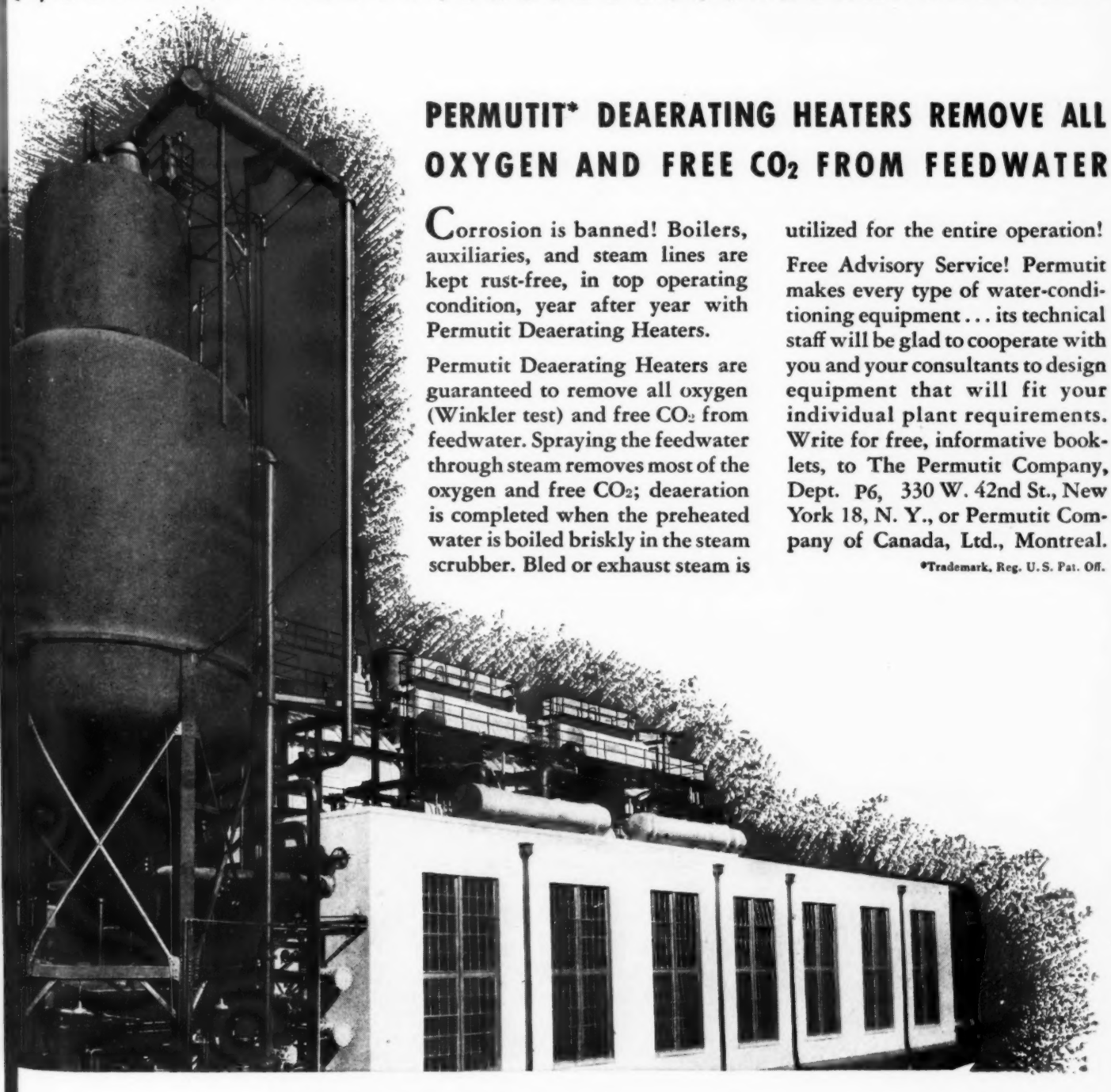
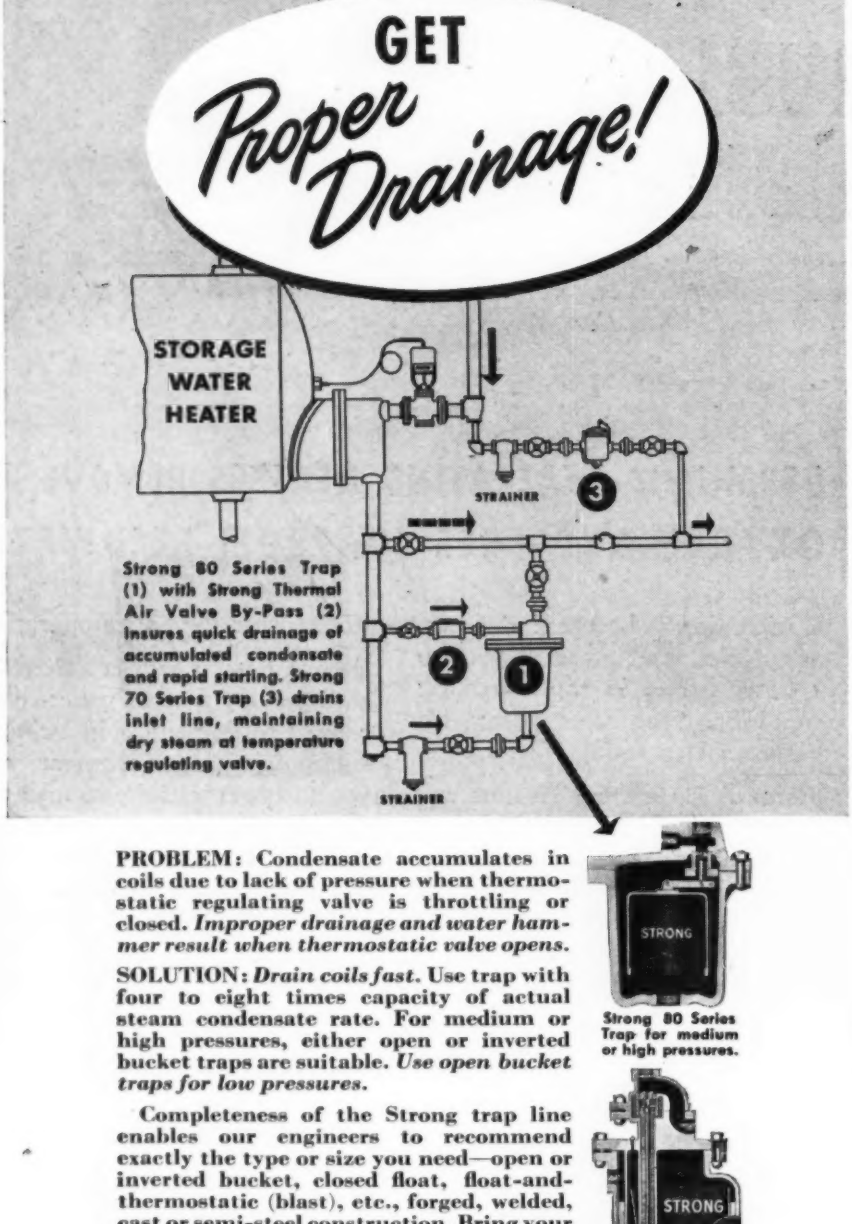


# PERMUTIT

WATER CONDITIONING HEADQUARTERS




Strong 80 Series Trap (1) with Strong Thermal Air Valve By-Pass (2) insures quick drainage of accumulated condensate and rapid starting. Strong 70 Series Trap (3) drains inlet line, maintaining dry steam at temperature regulating valve.

**PROBLEM:** Condensate accumulates in coils due to lack of pressure when thermostatic regulating valve is throttling or closed. *Improper drainage and water hammer result when thermostatic valve opens.*

**SOLUTION:** *Drain coils fast.* Use trap with four to eight times capacity of actual steam condensate rate. For medium or high pressures, either open or inverted bucket traps are suitable. *Use open bucket traps for low pressures.*

Completeness of the Strong trap line enables our engineers to recommend exactly the type or size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc., forged, welded, cast or semi-steel construction. Bring your drainage problems to us for solution. Send for Strong Trap Catalog No. 67 today for complete details of *all* Strong traps.

Strong 80 Series Trap for medium or high pressures.

Strong 30 Series Trap for high, medium or low pressures.

**STRONG, CARLISLE & HAMMOND COMPANY**
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REG. TRADE MARK

ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES




Reducing Valve | 70 Series Trap | Strainer

STRONG


vibration unknown in reciprocating engines.

From standpoint of engine performance, a satisfactory fuel for gas-turbine engines must burn cleanly and not cause deposition of carbon or coke in combustion chamber. Such coke formation, in addition to being an indication of incomplete combustion with consequent loss in efficiency, may also promote warping and distortion of metal liners of combustion chamber by preventing even dissipation of heat. Furthermore, large particles of coke may become dislodged and severely damage turbine blades.

Fuels for aircraft gas-turbine engines at present time range in volatility from that of 100-octane aviation fuel, which is frequently employed because of its availability, to that of kerosene. Present indications are that fuels of higher boiling ranges are not entirely satisfactory in combustion chambers of gas-turbine engines. They are also unsatisfactory because of their low-temperature properties.

Knowledge of fundamental variables controlling high output combustion is essential for further development of gas-turbine fuels. Studies of the fundamentals of combustion are under way in the gas-turbine laboratory.

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**Jury of Award** of Western New York Section of American Chemical Society has awarded the Jacob F Schoellkopf Medal for 1947 to Dr Leo I Dana, manager of research for Linde Air Products Co and its associated units of Union Carbide and Carbon Corp. Award of the medal was made for Dr Dana's scientific work, while a member of Western New York Section, particularly for his solution of a major distribution problem in the chemical industry. The award jury's report referred to laboratory efforts directed by Dr Dana that led to making large shipments of liquid oxygen and nitrogen "available to industry in a safe and industrially practical manner."

**Case School of Applied Science,** Cleveland, Ohio, will be known as Case Institute of Technology. The June graduating class will be the last to receive degrees from Case School of Applied Science; future classes will be CIT graduates.

**Rochester Gas & Electric Corp** revealed plans for a 25-million dollar expansion program, to be spread over the next two years. Major item in the project is the new steam-power plant to be erected on the lake shore, first unit of which will cost about 8 million dollars. Other planned installations include additional boiler capacity in present steam plants, a 34,500-v transmission line around City of Rochester to improve interconnection of all power sources, 105 miles of new rural electric lines, and other equipment.

# *One tape that does the work of TWO*

For literally a countless number of uses in plant, shop and home, Anchor Duo-Tape is finding wide favor. This new tape, introduced only two months ago by The Anchor Packing Company, is a multi-purpose tape, having very strong adhesion and the layers will fuse or weld together with slight finger pressure.

Ideal for insulating both inside and outside wiring and in the maintenance and repairing of motors, generators, transformers and similar equipment. Also for repairing rubber hose and tubing, lamp cords, etc. It does the work of two tapes, and only DUO-TAPE is needed. Approved by Underwriters' Laboratories.

***Write today for new booklet describing ANCHOR DUO-TAPE fully.***

## THE ANCHOR PACKING COMPANY

**GENERAL OFFICES: PHILADELPHIA, PA.**

**FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.**

### BRANCH OFFICES

Gay and Lombard Streets . . . . . Baltimore 2, Maryland
150 Causeway Street . . . . . Boston 14, Massachusetts
Andrews Building . . . . . Buffalo 2, New York
Rockefeller Building . . . . . Cleveland 13, Ohio
220 East Ohio Street . . . . . Chicago 11, Illinois
4 West 7th Street . . . . . Cincinnati 2, Ohio
169 West Jefferson Avenue . . . . . Detroit 26, Michigan
509 Washington Avenue . . . . . Houston 2, Texas
720 Mateo Street . . . . . Los Angeles 21, California
5575 Cote St. Paul Road . . . . . Montreal 20, Canada
418 Common Street . . . . . New Orleans 4, Louisiana
100 6th Avenue . . . . . New York 13, New York
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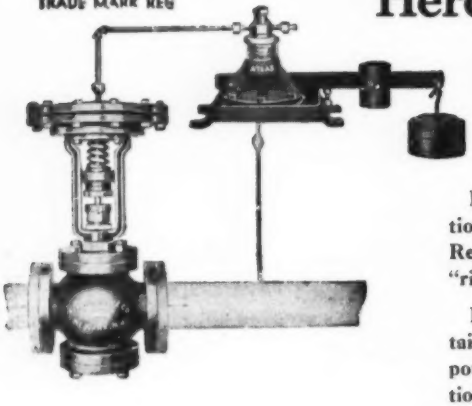
Terminal Sales Building . . . . . Portland 1, Oregon
156 South Park . . . . . San Francisco 7, California
2207 1st Avenue South . . . . . Seattle 4, Washington
1407 Pine Street . . . . . St. Louis 3, Missouri
921 South Richmond Street . . . . . Tulsa, Oklahoma
524 Avalon Boulevard . . . . . Wilmington, California

# *Super-Sensitive* PRESSURE REGULATORS

# ATLAS

TRADE MARK REG



## Here is a Regulator that Will Please You.

Load fluctuations and pressure variations make no difference to this ATLAS Regulator—it maintains desired pressures "right on the line".

In other words, if you want to maintain pressures within fractions of one pound—and without perceptible variation—specify this ATLAS Super-Sensitive Regulator.

Applicable to steam, gas, air, etc., where it is essential to maintain a constant reduced pressure in heating mains, vats, cookers, retorts, etc. It may also be applied as an altitude regulator to maintain constant level in open tanks, or as a pump governor to assure constant pump discharge pressure.

This remarkable regulator accommodates itself to an almost limitless range of applications. It regulates, accurately, between the initial pressure and atmosphere in one stage, operating control valves from ½" to 6".

Write for Bulletin No. 1B. It gives complete details.

| *For Reduced Pressures* | *Specify* |
|---|---|
| 2 to 15 lb. | No. 801 |
| 0 to 5 lb. | No. 801-8 |
| 15 to 150 lb. | No. 802 |

Sizes: ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 4", 5", 6".

Below We List the Principal ATLAS Products.

*Check the items on which you want complete information and mail to us with your name, firm name, and address.*

- ☐ Super-sensitive Pressure Regulators
- ☐ Other Pressure Regulators
- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ Pump Governors
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

*Specialists in Regulation for Nearly a Half Century*

**289 SOUTH ST., NEWARK 5, N. J.**

*Representatives in Principal Cities*


## APPOINTMENTS

Under a newly adopted regional setup for the field organization of **Allis-Chalmers** general machinery div, branch offices in the new regions become district offices. The following are designated now as district managers in first four regions established: (1) In New England region, A B Frost and R H Porterfield are managers of New Haven and Providence district offices, respectively, reporting to W F Taylor, Boston, manager of the region. States covered are Me., N. H., Ver., Mass., Conn. and R. I. (2) In Southwest region, W R Horrigan, Aubrey Phillips, E R Hury, L G Park and R I Moore are managers of Amarillo, Houston, San Antonio, Shreveport and Tulsa district offices, respectively, reporting directly to J L Pratt, region manager, who has been succeeded as manager of Dallas district office by H L Reynolds. This region covers Tex., parts of Ark., Okla., Kan., La., N. M., and a portion of state of Coahuila in Mexico.

(3) In Southeast region, J J Greagan, William Parker, J W Roberts, G H Hoffman, A R Knauss, Joseph Bronaugh, R F Muller and A D Robertson are managers, respectively, of Birmingham, Charlotte, Chattanooga, Knoxville, Memphis, Miami, New Orleans and Tampa district offices of **Allis-Chalmers,** reporting directly to D S Kerr, manager of the region, who is succeeded as manager of Atlanta district office by Charles F O'Riordan. This region covers N. C. and S. C., Ga., Fla., Ala., Tenn., Miss., a portion of Ark. and La., and three counties in Mo. (4) In Pacific region, F V Sams, F Harvey Searight and U E Sandelin remain as managers of Portland, San Francisco and Seattle district offices, respectively, reporting directly to A J Schmitz, manager of the region, which covers Calif., Nev., Ore., Wash., northern Idaho and three counties in Mont.

In the same region, C W Schweers becomes manager of Los Angeles district office of **Allis-Chalmers,** succeeding A D Brown, named manager of Washington, D. C., office. I C Matheson has been transferred to Los Angeles office, where he will specialize in handling utility business in that area. R N Landreth now devotes full time to his special duties as assistant to Vice-President Johnson. A R Kohlmetz remains as manager of Spokane branch of Seattle district.

**Tube Turns, Inc,** moved their Chicago offices to 600 S Michigan Ave. The new offices will be headquarters for George C Anderson, district manager of welding fittings division, and Donald A MacNeil, district manager of forging divisions.

Frank E Gerlitz Jr was appointed sales manager of **Simplex Valve & Meter Co.**

Dr Glenn T Seaborg, professor of chemistry at University of California and co-discoverer of the artificial element plutonium used in one form of atomic bomb, has been named as consultant in nucleonics to **General Electric** research laboratory at Schenectady. L M Biggs has been named manager of construction engineering div.

# CONFIDENCE . . . how much is it worth?

IN 1846, twenty three years before the Golden Spike was driven at Ogden, Utah marking the completion of the first transcontinental railway, John August Roebling built America's first truly practical, wire rope suspension bridge. This bridge, which carried traffic across the Monongahela River for scores of years, stood as a silent testimonial to his confidence in a principle of bridge building which, in that day, was looked upon with considerable misgiving.

How much is this confidence worth to bridge engineers, and to humanity as a whole, today?

Had it not been for his confidence there would have been no Brooklyn, George Washington nor Golden Gate Bridges. Had it not been for your confidence in the company that bears this pioneer's name, there could have been no John A. Roebling's Sons Company.

Your confidence is valued above all of this company's assets. Every Roebling employee's job depends upon his ability to preserve that confidence by producing better products and by giving you better service than you can find elsewhere.

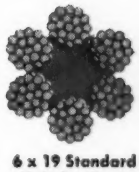
Any product is only as good as the organization that makes it.

## For the Right Rope for Your Equipment Choose a "Blue Center" Steel Wire Rope!

It's easy to find the right wire rope for your job when you can choose from a wide range—the one construction, size, and grade of steel that will give you most service at lowest cost.

That's why, whatever you need in wire rope, you're sure of finding it in Roebling's *complete* line of "Blue Center" Steel Wire Rope, in either preformed or non-preformed types. Illustrated are just a few of the more commonly used constructions. Each is the finest we know how to make . . . and each is made of Roebling's famous "Blue Center" Steel.

Your Roebling Field Engineer has the broad knowledge and experience needed to help you select the wire rope that will give you greatest returns in dependable, low-cost performance. He's at your service. Call him at our nearest branch office.



6 x 19 Standard Hoisting Rope

8 x 19 Extra Flexible Hoisting Rope

6 x 19 Haulage Rope

6 x 30 Flattened Strand Rope

6 x 7 Standard Coarse Laid Rope

18 x 7 Non-Rotating Hoisting Rope

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
*Branches and Warehouses in Principal Cities*

**ROEBLING**

**A CENTURY OF CONFIDENCE**

Manufacturers of Wire Rope and Strand • Fittings • Slings • Screen, Hardware and Industrial Wire Cloth • Aerial Wire Rope Systems • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Ski Lifts • Electrical Wire and Cable • Suspension Bridges and Cables • Aircord, Aircord Terminals and Air Controls • Lawn Mowers

"Flexitallic" GASKETS
How Flexitallic Precision Brings a New Degree of Safety
for sealing steam and other fluids under pressure
FLEXITALLIC GASKET CO.
8th & Bailey Sts.
Camden, N. J.

# NEW SAFETY IN GASKETS
# —will you read about it?

This new little book speaks of safe-sealing for fluids under pressure with the plain honesty the subject of safety deserves.

It tells with sketches and few words how the "Flexitallic" art which established itself in wide use through safe performance has now put safety on a new level.

You are not asked to abandon one theory and accept another. The book deals with a record of performance and identifies the practices that make the record possible. You are urged to believe only what pre-testing can—and will—prove to you.

**WE'LL SEND YOU A COPY**

A post-card will serve but you will help us in record-keeping by giving us the name of your company and your title or department.

"Flexitallic"

GASKETS OF THIS NAME ARE MANUFACTURED ONLY BY

**FLEXITALLIC GASKET COMPANY**

ORIGINATORS OF SPIRAL-WOUND GASKET CONSTRUCTION

8th & BAILEY STREETS CAMDEN, N. J.

Biggs succeeds C M Rhoades, who retired April 1. Thomas M Linville has been appointed staff assistant to E E Johnson, manager of engineering in apparatus dept. Linville's duties will include, in addition to special assignments, technical direction of engineering education for apparatus dept and coordination of development programs of all motor and generator design engineering divisions.

**General Electric Co** elected William H Milton Jr a commercial vice-president. Milton will have responsibility for customer relations in District of Columbia, with headquarters in Washington. Ray W Turnbull was also elected a commercial vice-president and therefore resigned as president of Hotpoint, Inc, GE manufacturing affiliate. On Sept 1, Turnbull with headquarters in San Francisco will assume responsibility for customer relations in an area that includes Calif., Ariz., Utah, Nev., Hawaii, and parts of Idaho and Wyo. In the meantime his headquarters will be in New York. Raymond M Alvord, now commercial vice-president in San Francisco, relinquishes his post to Turnbull Sept 1 and retires on Sept 30 after 43 years of service with the company.

Edwin E Potter has been elected vice-president in charge of commercial aspects of **GE's** relations with customers, succeeding Vice-President Earl O Shreve, who continues as a member of the president's staff, in charge of customer relations. His headquarters are in New York City.

**Plibrico Jointless Firebrick Co,** Chicago, Ill., announces appointment of Robert C Ledford as manager of Plibrico Sales & Service Co, 531 W Main St, Oklahoma City, Okla.

H M Hammond and P S Dickey have been elected vice-presidents of **Bailey Meter Co.** Hammond will continue to direct all sales activities of the company. Dickey will continue to direct the company's engineering activities and to advise its foreign affiliates in engineering problems. Portilla Corp has been appointed agent in Puerto Rico. This corporation has taken over the business formerly conducted by H Clyde Gregory, Inc. Portilla Corp will act as the agency for sales, installation and servicing of Bailey equipment in Puerto Rico, Republic of Haiti, Dominican Republic and Virgin Islands.

**Brown Instrument Co** has extended its program of sales and service expansion to Baltimore area. W J Law will be in charge of sales, assisted by J F Maienshein. Their headquarters will be at 1209 E 25th St, Baltimore.

Announcement was made by **Nordberg Mfg Co** of appointment of Charles E Beck and A S Telfer as special representatives of heavy machinery div. Beck will have his headquarters at Busch-Sulzer Div at St. Louis. Telfer will specialize in diesel engines for oil pipeline service and will cover Texas and midcontinent fields, with headquarters at Houston, Tex. J T Adams and E C Brooks have been made sales engineers in heavy machinery div. Adams

# a New Idea in A.C. and D.C. Switching Relays

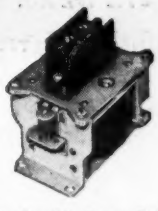
**Using a magnetic actuator with one or more self-contained contact mechanisms of the quick-make and break type**

Class 7001 D.C. and Class 8501 A.C. Type P Relays have magnetic actuators and contact mechanisms of similar design.

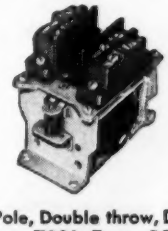
**APPLICATION** • Switching relays are used to set up complicated control circuits, pilot larger magnetic devices, energize lights or audible signals, isolate low voltage circuits and occasionally to control very small motors having integral overload protection. They must be compact, inexpensive, fast, dependable, easily installed, and have comparatively low magnet coil demand.

**SQUARE D's DESIGN** meets those specifications. It is mounted and wired from the front, requires no extra space for electrical or mechanical clearances; consists of standard parts; has short stroke and straight line action; utilizes one, two or three individually-enclosed snap-action contacts of double-throw construction; can be readily converted to meet job requirements; and comes with either A.C. or D.C. magnetic actuators of similar design.

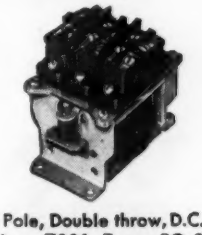
*Flexibility* is a characteristic of growing importance in the field of automatic control. Use of an A.C. or D.C. magnetic actuator of similar design with one, two or three self-contained contact mechanisms, each having one normally-open and one normally-closed contact, results in a switching relay to meet nearly all requirements. Actuators with only one contact mechanism (carried in stock) may be readily converted to additional poles by installation of either one or two additional standard contact mechanisms, also from stock. Contact mechanisms are easily and quickly renewed in the field with a minimum of expense.



1 Pole, Double throw, D.C. Class 7001 Type PO-1



2 Pole, Double throw, D.C. Class 7001 Type PO-2



3 Pole, Double throw, D.C. Class 7001 Type PO-3

*Write* for complete details on Type P Switching Relays. Address SQUARE D CO., 4041 N. Richards St., Milwaukee 12, Wis.

**CONTACT RATINGS**

| | A.C. Voltage | | | | D.C. Voltage | | |
|---|---|---|---|---|---|---|---|
| Electrical Ratings | 110 | 220 | 440 | 550 | 115 | 230 | 550 |
| Normal Amperes | 15 | 10 | 6 | 5 | 2 | 0.5 | 0.1 |
| Inrush Amperes | 40 | 20 | 10 | 8 | ... | ... | ... |

**SQUARE D COMPANY**

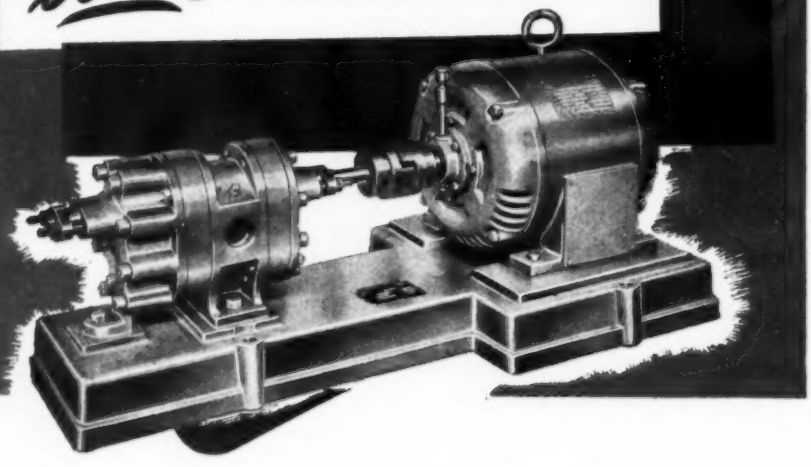
DETROIT • MILWAUKEE • LOS ANGELES

*In Canada:* SQUARE D CANADA, LTD., TORONTO, ONT. • *In Mexico:* SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

## Sier-Bath Precision Built

# GEAREX ROTARY PUMPS

## *slash* maintenance costs



The high cost of maintenance crews plus increased competition make mechanical breakdowns more costly than ever before.

Sier-Bath employs "tool room" manufacturing methods to give Gearex Pumps closer tolerances and better fitting parts . . . the answer to pump maintenance problems. Exact rotor clearance is achieved by accurate timing gears and roller bushings. The result: maximum operating efficiency at high speeds. Non-contacting rotors cut wear. Vibrationless operation does away with costly foundations. Pulseless flow eliminates wasteful wear on attachments . . . they last longer and need less attention.

Your choice of horizontal or vertical models . . . of steel or special alloys for specific applications. Jacketed bodies are available for high temperature jobs. Write for full details today.

- Balanced Axial Thrust
- Pulseless Flow
- Vibrationless Operation
- Roller Bushings for Precision Running under load

PUMPS: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

CAPACITIES: 1-550 g.p.m.

DISCHARGE: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.

FOR HIGHER PRESSURES AND CAPACITIES USE SIER-BATH SCREW PUMPS

Sier-Bath GEAR and PUMP CO., Inc.


will have his headquarters in newly established district office in Cotton Exchange Bldg, Dallas, Tex. Brooks will have his headquarters at Minneapolis, Minn.

**Babcock & Wilcox Co** elected Alfred Iddles a director.

Isaac Harter has been named chairman of board of **Babcock & Wilcox Tube Co.** He retired as vice-president and director of Babcock & Wilcox Co.

**Union Asbestos & Rubber Co** announces acquisition of all capital stock of Carolina Asbestos Co. One plant is located at Davidson, and the other at Marshfield, N. C.

N C Michels has been appointed chief engineer of **Laclede-Christy Clay Products Co.** E H Krautheim has been made assistant chief engineer in charge of plant engineering and maintenance, and Les Mueller assistant chief engineer of arch and wall div. Herman W Weber has been added to executive staff as consulting engineer.

Foxboro Co announces that all its facilities for servicing of Dr Horn portable tachometers have been acquired by **James G Biddle Co,** 1316 Arch St, Philadelphia 7, Pa.

Henry S Elder has been named vice-president of **Titeflex, Inc.**

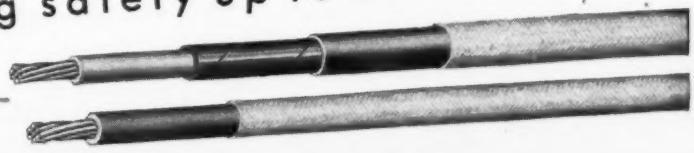
**Milton Roy Co** elected following officers: Robert T Sheen, president; John W Welker, vice-president and general manager; E Elizabeth Sheen, secretary; John J Smith, treasurer.

Emmett W MacCorkle Jr has been elected **Air Reduction's** Portland district manager. Portland district encompasses entire state of Oregon, southern half of Idaho, and a part of state of Wash. in vicinity of Walla Walla. Herman Van Fleet Jr has been made manager of New England district, covering states of Me., Ver., N. H., Mass., R. I. and eastern third of Conn. Van Fleet's headquarters will be at 122 Mt Vernon St, Boston. In addition to his sales function, Van Fleet will be in charge of plants at Boston; South Portland, Me.; and Central Falls, R. I. L A Hamilton has been named manager of Seattle district, covering practically entire state of Wash., northern part of Idaho and state of Montana.

**Kellex Corp,** subsidiary of M W Kellogg Co, announced that M W Kellogg has been elected to newly created post of chairman of board of Kellex Corp. H R Austin succeeded Kellogg as president of Kellex. Austin will hold his Kellex post concurrently with his position as president of Kellogg Co.

**Ampco Metal, Inc,** has named John C Fitzpatrick Co, Toronto 1, Ont., Canada, as sales agent in province of Ontario. Fitzpatrick organization will handle sale of Ampco products, except safety tools and arc-welding electrodes, which will continue to be sold by other agents specializing in these fields. Anstice Co, Rochester,

# NEW! silicone-treated DELTABESTON* CABLES for wiring safety up to 200 C



***Where heat's a problem***—On wiring installations where high temperatures knock out most types of insulation, the new Deltabeston cables are prepared to beat the heat. Even at continuous operating temperatures of 200 C (392 F), they stay in service without a letup. The secret: felted asbestos insulation, treated for extra heat resistance with the new, tough silicone varnish. Silicone-treated Deltabeston power cables are now available in two ratings—for 300- and 600-volt service.

***Where moisture is a troublemaker***—When wiring has the habit of going out of service because it can't stand up against moisture, it's time to switch to Deltabeston. Its silicone-treated insulation is right for keeping out moisture, caused by wet conditions during operation or by condensation after operation. To do an effective job of keeping moisture out, put the new silicone-treated Deltabeston cables in.

***Where rough handling is the rule***—A tough, silicone-treated glass braid gives the new Deltabeston cables protection against rough treatment, gives them the kind of strength needed to stand up against frequent rough handling. It's ideal for reducing maintenance costs in and around motors, ovens, furnaces, control apparatus, and other installations where abrasion goes along with moisture and heat.

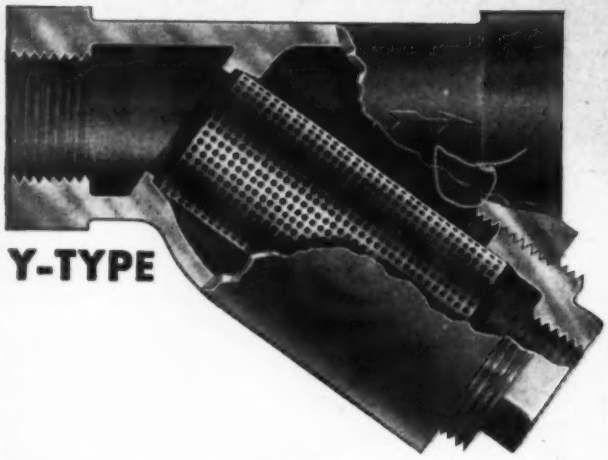
***Underwriters' Approved***—These wires are approved for use in the wiring of ovens or other high-temperature equipment, such as furnaces and control apparatus, where the acceptability of the wire for the particular use has been determined by the Underwriters' Laboratories, Inc. For information, write to Section Y70-663, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

**Trade-mark Reg. U.S. Pat. Off.*

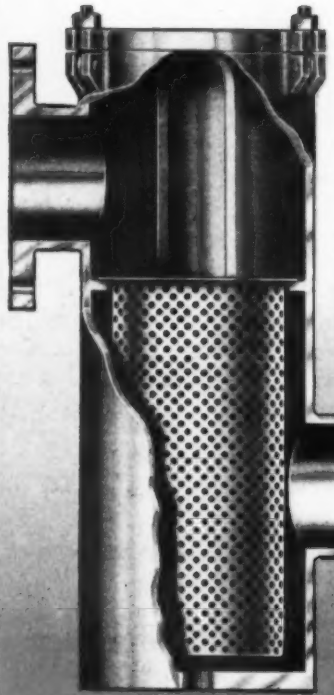
**DELTABESTON wires and cables built to beat the heat**

**GENERAL ELECTRIC**

# ADSCO STRAINERS



Y-TYPE



It pays to safeguard regulators, pumps, valves, traps and other equipment with ADSCO Strainers.

Made in a wide range of standard and special types and sizes in ferrous and non-ferrous metals to suit customer's requirements. Write for Bulletin 46-50PR.

S-TYPE
Suction or Pipe Line Strainer.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N.Y.

MAKERS OF UP-TO-DATE STEAM LINE EQUIPMENT FOR OVER 45 YEARS

**ADSCO**

**Representatives in Following Cities**

ALABAMA
Birmingham 3-1495

CALIFORNIA
Los Angeles Chapm. 5-2693
San Fran. Exbrook 4000

COLORADO
Denver Keystone 5111
Grand Junction 2242
Pueblo 2085

DIST. OF COLUMBIA
Wash. Republic 6116

GEORGIA
Atlanta Jackson 3696

ILLINOIS
Chicago Central 3434

INDIANA
Indianapolis Riley 1926

IOWA
Cedar Rapids 3-2019
Des Moines 4-3231

KENTUCKY
Louisville Shawnee 9026

LOUISIANA
New Orleans Ray. 7984

MARYLAND
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MASSACHUSETTS
Boston Hubbard 8352
Greenfield 6763

MICHIGAN
Detroit Tyler 7-2750
Kalamazoo 3-2567

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Duluth Melrose 3394
St. Paul Garfield 5811

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Cleveland Prospect 4108
Dayton Fulton 9114
Middletown 2-6367

OKLAHOMA
Tulsa 4-2908

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PENNSYLVANIA
Phila. Lombard 4900
Pittsburgh Atla. 6083

SOUTH CAROLINA
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SOUTH DAKOTA
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TENNESSEE
Knoxville 3-9219

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El Paso Main 1787
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UTAH
Salt Lake City 4-6421

WASHINGTON
Seattle Eliot 4425

WISCONSIN
Milwaukee Kilb. 8210

WYOMING
Caspar 1656

ONTARIO, CANADA
Toronto Rand. 3166

QUEBEC, CANADA
Montreal Lanc. 1823

HAWAII
Honolulu P.O. Box 2755


N. Y., has been made Ampco agents in western New York, and will handle sale of all Ampco products except resistance welding and arc-welding electrodes.

John C Vander Pyl was elected president of **American Machine & Metals, Inc,** succeeding P G Mumford. Mumford was reelected chairman of board of directors. Charles W Anderson was chosen to succeed Vander Pyl as executive vice-president. I Newton Becker succeeds Anderson as vice-president and general manager of U. S. Gauge Div. Philip S Mumford became a vice-president of the corp.

**Graybar Electric Co** announces appointment of John W Van Dorsten as manager of Graybar office and warehouse at Winston-Salem, N. C. Van Dorsten succeeds W A Moorefield, who was transferred some time ago as assistant to Southeastern district manager there.

Dudley & Garland, newly formed Boston sales engineering firm, has been named New England representative of the industrial div of **Bryant Heater Co.** The new firm, at 176 Federal St, will handle application of Bryant industrial gas-combustion equipment in all six New England states, with exception of southwestern Conn., which will continue to be served by Bryant N. Y. district office.

**Thermoid Co** has acquired a new warehouse in Wabash, Ind. All business formerly handled by the key warehouse in Chicago was transferred and that operation was closed. New warehouse is operated by a staff of 18, under direction of H L Conover.

**Young Radiator Co** has announced addition of James A Stahn as engineering representative.

Dr Eugene M McColm has been appointed technical director of plantation div of **U. S. Rubber Co.** Richard P. Harris has been made factory manager of electroforming dept at Detroit.

**Liquid Conditioning Corp** named William O Lovejoy as its representative in Fla. Lovejoy's headquarters are at 1366 Holmesdale Rd, Jacksonville 5, Fla.

B A Cotharin has been made Eastern special accounts manager of **Sylvania Electric Products Inc,** with headquarters in Cleveland, Ohio.

**Dampney Co of America** announces appointment of Combustion Equipment & Insulation Co, 1900 Euclid Ave, Cleveland, Ohio, as agent in Cleveland area for sale of Apexior and Thur-Ma-Lox protective coatings.

**Wheelco Instruments Co** elected Elmer Schneider to newly created position of vice-president and director of engineering. Joseph A Reinhardt became plant manager.

Young & Vann Supply Co, 1731 First Ave, Birmingham 2, Ala., has been appointed authorized distributor for **Carboloy Co.** In addition to Birmingham, Young & Vann

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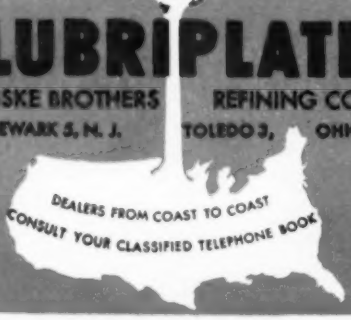



Supply Co will supply users throughout Ala., northwest Fla. and southwest Ga. W M Given, vice-president of Young & Vann Supply Co, will head up the new Carboloy operation.

W H Stewart has been reassigned to home office of **Hagan Corp** and Hall Laboratories at Pittsburgh as sales engineer for combustion control and boiler-water conditioning. R R Donaldson has been named chief engineer.

**General Electronics, Inc,** has enlisted services of Land-C-Air Sales, Inc. The newly acquired sales organization is composed of three active principals: Walter C Hustis, Paul Nichols and Robert E Sargent. Nichols will represent General Electronics in metropolitan N. Y. and upper N. Y. State. Hustis will cover entire New England area. Sargent will make contacts from N. J. south to Norfolk, Va., and west to Harrisburg, Pa.

William Gold has been added to list of representatives of **General Electronics, Inc.** Gold will serve New York area.

**Leslie Co** announces appointment of following agents to handle industrial sales and service: (1) Plant Equipment, Inc, Minneapolis, Minn. (2) Fluid Equipment Co, Dallas, Tex. (3) Avery M Walsh & Sons, Albany, N. Y. (4) Claude B Smith, 615 Sansome St, San Francisco 11, Calif. (5) Joseph Tripoli, 401 Chamber of Commerce, Buffalo 2, N. Y. (6) Riley Power Equipment Co, 7025 W Cedar St, Milwaukee 13, Wis. (7) Stem & Heider, 135 Spring St, Rochester 8, N. Y.

Big Three Welding Equipment Co opened their new sales and supply office at 565 W Commerce St, Dallas, Tex. This company handles equipment manufactured by **Lincoln Electric Co.**

John F Marquitz has been made assistant manager of railroad div of **Fairbanks, Morse & Co,** Chicago, Ill Marquitz succeeds John S King, who a short time ago was appointed manager of Chicago branch.

**Independent Pneumatic Tool Co** announces opening of a technical office at Sao Paulo, Brazil. Reuben P Rudy has been named manager of the new office.

Schweitzer & Conrad, Inc, will hereafter be known as **S & C Electric Co.**

**Pennsylvania Flexible Metallic Tubing Co** increased its facilities in Midwestern industrial territory. Company opened a warehouse and sales office at 4352 W Harrison St, Chicago. Also, a new and enlarged headquarters was opened in Los Angeles, including a warehouse and sales office.

Promotion of Dr Robert A Ruehrwein to research group leader in central research dept of **Monsanto Chemical Co** at Dayton, Ohio, was announced. Monsanto opened a new sales office at 140 Federal St, Boston, to handle regional sales of organic chemicals, phosphates, alcohol and dry ice,

(*Continued on page* 200)

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**Couplings**

Users have learned that the design refinements of this new Waldron Coupling eliminate the chief causes of trouble and shutdowns. With no flexible hub connections to fatigue, no non-lubricated metal-to-metal contact between moving parts to cause wear, the Waldron Coupling easily proves the most economical coupling to buy and use.

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### AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

**1** **UNIT HEATERS**—C A Dunham Co, 450 E Ohio St, Chicago 11, Ill. Bulletin presents Dunham floor, wall and ceiling unit heaters. They supply fresh or recirculated air, heated and distributed evenly throughout the area.

**2** **STEEL INSULATION** — American Flange & Mfg Co, 30 Rockefeller Plaza, New York, N. Y. 12-page booklet discusses value of steel insulation for cold-storage construction. Photos and diagrams are included.

**3** **AIR RECOVERY PANELS**—W B Connor Engrg Corp, 114 E 32nd St, New York 16, N. Y. 20-page bulletin No. 106-A describes Dorex Type G activated carbon air recovery panels for air conditioning systems and units. Design, construction, function and application of these units are given.

**4** **COOLING EQUIPMENT**—Santa Fe Tank & Tower Co, 5401 Boyle Ave, Vernon, Calif. Publication No. CE47 covers cooling towers, fin units, spray ponds, etc. It contains latest innovations in cooling equipment industry, plus timely information on current cooling problems.

**5** **STEEL INSULATION** — American Flange & Mfg Co, 30 Rockefeller Plaza, New York, N. Y. 6-page reprint, entitled "Steel Sheets That Insulate," explains use of thin, steel sheets of Ferro-Therm in construction of refrigerated structures.

**6** **AIR FILTERS**—American Air Filter Co, 215 Central Ave, Louisville 8, Ky. 23-page booklet discusses various industrial dust problems and typical applications of AAF air filters to such problems.

**7** **HEATING, AIR CONDITIONING**—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 12-page bulletin No. 25B6183 presents Allis-Chalmers products for heating, ventilating and air conditioning. Equipment portrayed and described includes Texrope V-belt drives, centrifugal pumps, ac and dc motors, motor controls, dry transformers and ac and dc welders.

**8** **EXTENDED-SURFACE RADIATION**—Warren Webster & Co, Camden, N. J. 8-page bulletin No. B-1550A gives construction and application of Type WI extended-surface radiation. Dimensions and ratings are included.

### BOILERS AND AUXILIARIES

**9** **HEAVY-DUTY REFRACTORIES**—Refractories Div, Norton Co, Worcester 6, Mass. 22-page catalog No. R-1-Q covers heavy refractories, consisting of bricks, plates, fabricated muffles, recuperator tubes, batts, saggers, burner blocks and miscellaneous shapes for furnaces heated by gas, oil, coal or electricity.

**10** **STEAM GENERATORS**—Preferred Utilities Mfg Corp, 1860 Broadway, New York 23, N. Y. 8-page bulletin No. 1000-E describes Preferred unit steam generators. These self-contained oil-fired steam-generated plants range from 40 to 500 hp.



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**11** **COAL CRUSHERS**—McNally Pittsburg Mfg Corp, Pittsburg, Kan. 4-page bulletin explains coal crushing and washing equipment. Photos and diagrams are included.

**12** **STEAM GENERATORS** — Superior Combustion Industries, Inc, Emmaus, Pa. 8-page booklet gives features, specifications and dimensions of Superior steam generators. They are fully automatic with all commercial standard grades of oil.

**13** **REFRACTORY CEMENT**—Building Materials Div, Armstrong Cork Co, Lancaster, Pa. 4-page booklet No. 11-26-247 describes Air Set cold-setting refractory cement for laying and facing clay firebrick or insulating firebrick.

**14** **STORAGE-TANK PREHEATER**—Rempe Co, 340 N Sacramento Blvd, Chicago 12, Ill. Single-sheet bulletin on Hot Spot preheater covers method of heating oil or other heavy-bodied substances in the bulk storage tank before they enter suction line.

**15** **FUEL-OIL HEATERS** — Davis Engrg Corp, Elizabeth, N. J. 28-page bulletin No. 60 presents Paracoil line of fuel oil heaters. Bulletin gives engineering data to enable engineers to readily ascertain the heaters best suited to their specific operating requirements.

## CONTROLS, ELECTRIC

**16** **MERCURY RELAYS**—Ebert Engrg & Mfg Co, 185-09 Jamaica Ave, Hollis 7, L. I., N. Y. Single-sheet bulletin No. 46 discusses advantages of Merctron mercury relays.

**17** **MAGNETIC CRANE CONTROL**—Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa. 20-page booklet describes five ac magnetic crane controls for handling any load.

**18** **MOTOR CONTROL**—Electric Machinery Mfg Co, Minneapolis 13, Minn. Folder includes sheets A2030, A2034, A2040 and A2041 on Hi-Fuse high-voltage combination control, adjustable-speed control, polarized field frequency control and motor pump applications.

**19** **DEMAND CONTROL**—Engineering Controls, Inc, 2833 E 11th St, Los Angeles 23, Calif. 4-page bulletin No. 102-L describes 16 models of E-C Lightrol engine-generator automatic load-demand control units. Featured is the new midget Lightrol that functions on all loads of 25 watts or more.

**20** **VOLTAGE REGULATORS**—Sorensen & Co, 375 Fairfield Ave, Stamford, Conn. 16-page catalog discusses principles of operation and technical specifications of electronically controlled voltage regulators and Nobatrons, which are ac and dc converters.

## CONTROLS, MECHANICAL

**21** **STEAM AND LIQUID CONTROL**—O C Keckley Co, 400 W Madison St, Chicago 6, Ill. Catalog No. 47 contains informative data on temperature regulators, water gages, pressure-regulating valves, relief and float valves, self-cleaning strainers, gage cocks, illuminators, steam traps, air separators, etc.

**22** **CONTROL SYSTEMS**—Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. 20-page bulletin No. 3-6400 explains Wheelco measuring and control systems. Multronic, proportioning, automatic positioning and program control are explained with graphs, diagrams and photos. Millivoltmeter, potentiometer and resistance thermometer controllers are shown, as well as indicating pyrometers and resistance thermometers, input controllers, portable pyrometers and potentiometers, and selector switches. Combustion safeguards and auxiliary equipment are included.

**23** **PROTECTIVE CONTROLS**—Viking Instruments, Inc, East Haddam, Conn. 32-page catalog No. 646 covers safety controls, pressure controls, temperature controls, etc, for internal-combustion engines.

**24** **STOKER CONTROL**—Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio. 4-page bulletin No. 1022, entitled "Control for Spreader Stokers," gives data on approved automatic control layouts for spreader stokers.

**25** **PRESSURE CONTROLLERS**—Leslie Co, 50 Delafield Ave, Lyndhurst, N. J. 20-page booklet, entitled "Engineering, Operating and Maintenance Data on Pressure Controllers, External-Pilot-Operated," covers the line thoroughly. Design features of Leslie control pilots and associated diaphragm regulating valves are given.

**26** **TEMPERATURE CONTROL**—Fenwal Inc, Ashland, Mass. 56-page catalog gives necessary facts for proper application of Thermoswitch thermostats to heat-control problems. Photos, diagrams and tables are given. Price list for Thermoswitch controls is included.

## ELECTRICAL EQUIPMENT

**27** **PACKAGE SUBSTATIONS**—General Electric Co, Schenectady 5, N. Y. 78-page publication No. GEA-4500 describes new package substations, rated from 750 to 45,000 kva, for utility and industrial power distribution.

**28** **INDUCTION MOTORS** — Reliance Electric & Engrg Co, 1076 Ivanhoe Rd, Cleveland 10, Ohio. 4-page bulletin No. C-118 on Series C induction motors covers protected (open type) frame sizes 203 to 326, with ratings of ½ to 20 hp, 600 to 3600 rpm. Totally inclosed fan-cooled Series C motors are described in bulletin No. C-125, which deals with squirrel-cage frame sizes 224 to 326, for 2- and 3-phase ac circuits.

**29** **CIRCUIT BREAKER**—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. 71B6179B presents Type DZ-40B oil circuit breaker. This breaker, of moderate capacity for indoor service, is of the oil-tight inclosed-mechanism type, with all three poles in one tank.

**30** **LIGHTING EQUIPMENT**—Edwin F Guth Co, 2615 Washington Ave, St. Louis 3, Mo. Revised catalog No. 44-A covers entire Guth line of fluorescent and incandescent lighting equipment.

**31** **NETWORK PROTECTORS**—General Electric Co, Schenectady 5, N. Y. 39-page bulletin No. GEA-2017C gives construction, applications and maintenance requirements of GE network protectors for ac secondary systems.

**32** **COMPRESSION CONNECTORS**—Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y. Bulletin No. M-3 describes line of standard compression connectors for aluminum. Bulletin lists terminals, couplers, parallel tap and T-connectors supplied in bolt and screw clamp types or Hydent indent types, for wire sizes from No. 12 to 1000 Mcm.

(*Continued on page 188*)

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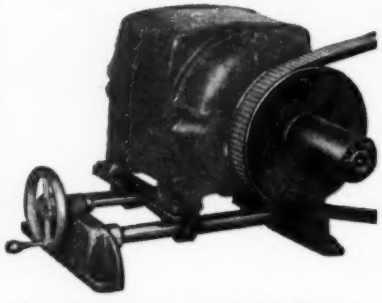

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For constant speed motors. Turn handwheel for any slow or fast speed of driven unit. Provides for production schedule changes — variation and density of parts—temperature—humidity.

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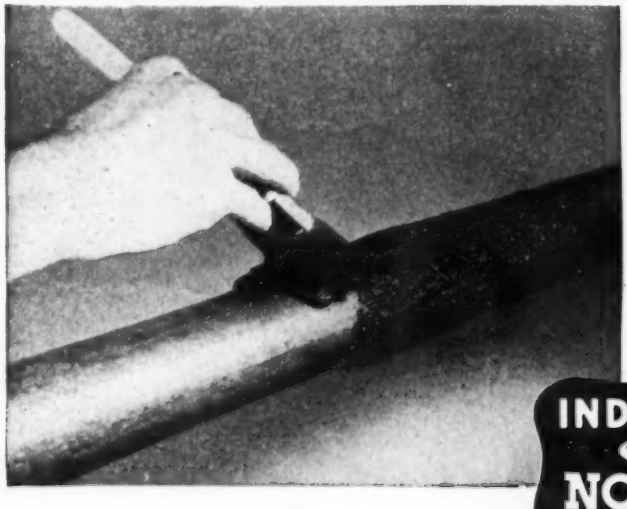

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**33** **STATION CUBICLES** — Apparatus Dept, General Electric Co, Schenectady 5, N. Y. 24-page booklet emphasizes important advantages of cubicles with air-blast circuit breakers and pneumatic operating mechanisms.

**34** **ALUMINUM WIRE**—Hazard Insulated Wire Works Div, Okonite Co, Wilkes-Barre, Pa. 6-page bulletin No. H-407 gives capacities, weights and characteristics of Hazard aluminum building wire. An insert discusses quick methods of determining voltage drop, conductor sizes, circuit length and currents for aluminum and copper. Bulletin also points out that fitting manufacturers have developed suitable connectors and terminal lugs for use with aluminum conductors. Wire list prices are covered in Bulletin No. 302-A1.

**35** **TRANSFER SWITCHES**—Apparatus Dept, General Electric Co, Schenectady 5, N. Y. 12-page bulletin No. GEA-4746 contains data on construction, operation and application of Type SB-1 control and transfer switches.

**36** **INFRA-RED RAY EQUIPMENT**—Fostoria Pressed Steel Corp, Fostoria, Ohio. 12-page booklet gives typical applications of Fostoria Evenray equipment for baking, drying, dehydrating, preheating or miscellaneous heating operations.

**37** **CIRCUIT BREAKERS**—Apparatus Dept, General Electric Co, Schenectady 5, N. Y. 12-page bulletin describes construction and operation of FK-139 breakers, rated 115 to 230 kv.

## MAINTENANCE AND SAFETY EQUIPMENT

**38** **OIL FILTERS**—Briggs Filtration Co, Bethesda 14, Md. 10-page booklet No. SM-164-46, with inserts, tells how Briggs filters operate.

**39** **MAINTENANCE TOOL** — Punch-Lok Co, 321 N Justine St, Chicago 7, Ill. 8-page catalog No. 235 discusses a simple method of clamping, splicing, tying, mending and banding. Kit contains a Clamp-Master tool for tensioning and locking all clamps, 31 flat strip steel clamps of assorted sizes, and 14 open-end clamps for use where the ends of object to be clamped are obstructed. 8-page folder No. 240 tells how to use the Clamp-Master.

**40** **FIRE - FIGHTING DEVICES**—American-LaFrance-Foamite Corp. Elmira, N. Y. 24-page booklet, entitled "What You Should Know About Modern Fire-Fighting Devices," describes proper use of various fire-fighting devices for class of fire for which each is intended.

**41** **OIL FILTERS**—Hilliard Corp, 102 W 4th St, Elmira, N. Y. 4-page bulletin No. F-154 presents "C" Series Hilco Hyflow oil filters. Tables of specifications are included.

**42** **BOILER-TUBE CLEANER**—Boiler Equipment Trust, Amherst, Mass. 4-page booklet gives construction features of BET boiler-tube cleaner.

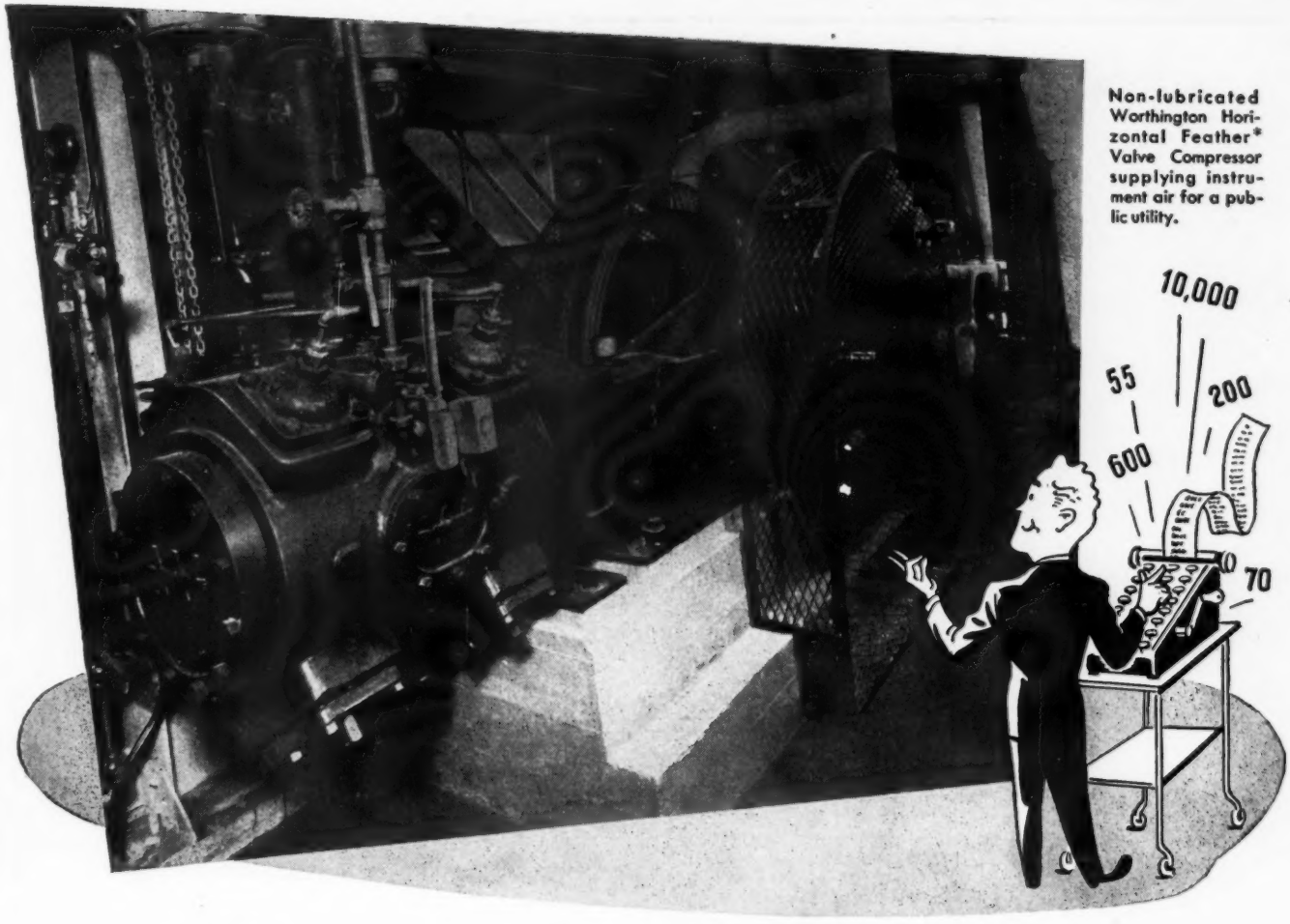
**43** **SEALED AIR CHAMBER**—Wade Mfg Co, Elgin, Ill. 6-page booklet, entitled "Water Hammer—Its Cause and Cure," introduces the Wade sealed air chamber as a solution to problem of water hammer in water-supply systems.

**All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.**

★ **FILES**—Grobet File Co of America, Inc, 421 Canal St, New York 13, N. Y. 24-page catalog, entitled "There's a Grobet Swiss File for Every Specific Purpose," lists 3566 different patterns, sizes and cuts of hand and machine files and rifflers.

## MAINTENANCE MATERIALS

**44** **FLOOR REPAIR**—Stonhard Co, 403 N. Broad St, Philadelphia 8, Pa. Folder, entitled "Over Ruts and Holes," outlines overlaying or patching of warn concrete, wood, brick or composition floors with Stonhard resurfacer.

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If getting low-cost air is your responsibility, you'll want to look into the 24 pages of this bulletin. Write for it today and learn why — in compressors, as in so much other equipment — *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

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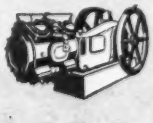
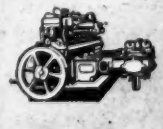
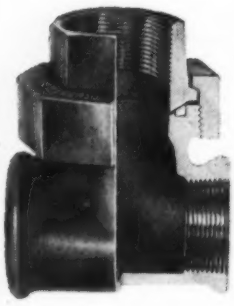
Horizontal 

Portable

Radial

Gas-Engine Compressors 



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MONEL SCREEN
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REVERSE UPWARD FLOW PASSING THRU SCREEN
Orifices cannot clog
PIECES OF SCALE
And other solids precipitated
MULTOMETER
Immediately adjustable to any one of nine different orifices to meet any condition of water or variation in boiler load
STAINLESS STEEL PLUG VALVE
Blow-off sediment Once every 24 hours
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*Weighs only 40 lbs.*

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It will not cut out or wear out in regular service.

We supply complete data and working drawings showing the best method of installation on various types of boilers.

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**45** **SPIRAL - WOUND GASKETS** — Flexitallic Gasket Co, 8th & Bailey St, Camden, N. J. Booklet presents Flexitallic gaskets for sealing steam and other fluids under pressure.

**46** **BUILDING MATERIALS** — Stonhard Co, 403 N Broad St, Philadelphia 8, Pa. Booklet contains useful information on constructing foundations and basements, laying of various floors, surfacing of interior and exterior wall surfaces, protecting exposed structural members, etc.

**47** **MECHANICAL PACKING**—Asbestos Textile & Packing Div, Raybestos-Manhattan, Inc, Manheim, Pa. 16-page catalog describes most popular styles of mechanical packings in the R/M line.

**48** **PROTECTIVE COATINGS**—Prufcoat Laboratories, Inc, 63 Main St, Cambridge, Mass. 4-page catalog lists features of Prufcoat and chemical agents it resists. Catalog provides a variety of actual case histories, as well as Prufcoat uses and complete application data.

**49** **ROOF MAINTENANCE**—Stonhard Co, 403 N Broad St, Philadelphia 8, Pa. Folder, entitled "Is Your Roof a Fair-Weather Friend," explains how to stop leaks, renew dried-out roof surfaces, repair flashings and gutters, etc.

### MECHANICAL TRANSMISSION

**All literature designated with a star (★) may be obtained only by writing direct to the manufacturer.**

**51** **FLEXIBLE COUPLINGS** — Industrial Machine Works, Inc, South Hanover, Mass. 4-page catalog describes IMW gear-tooth flexible couplings.

**52** **DOUBLE HELICAL GEARS** — Moore Steam Turbine Div, Worthington Pump & Machinery Corp, Wellsville, N. Y. 12-page bulletin gives specifications and applications of Worthington-Moore double helical gears.

**53** **CHAIN BELTS**—Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis. 12-page bulletin No. 46-10 describes Rex steel-fabricated and cast chains for every industry. Attachments for Rex conveyor chains are shown. Informative data on Rex cast- and cut-tooth sprockets are given.

**54** **PLASTIC GEARS**—Mica Insulator Co, P O Box 1076, Schenectady 1, N. Y. Booklet tells how to make gears with Lamicoid, a laminated phenolic plastic. Booklet points out applications for Lamicoid gears.

### METERS AND INSTRUMENTS, MECHANICAL

**55** **CONDENSATION METER**—American District Steam Co, North Tonawanda, N. Y. 12-page bulletin No. 35-80B covers construction and installation on seven sizes of ADSCO rotary condensation meter.

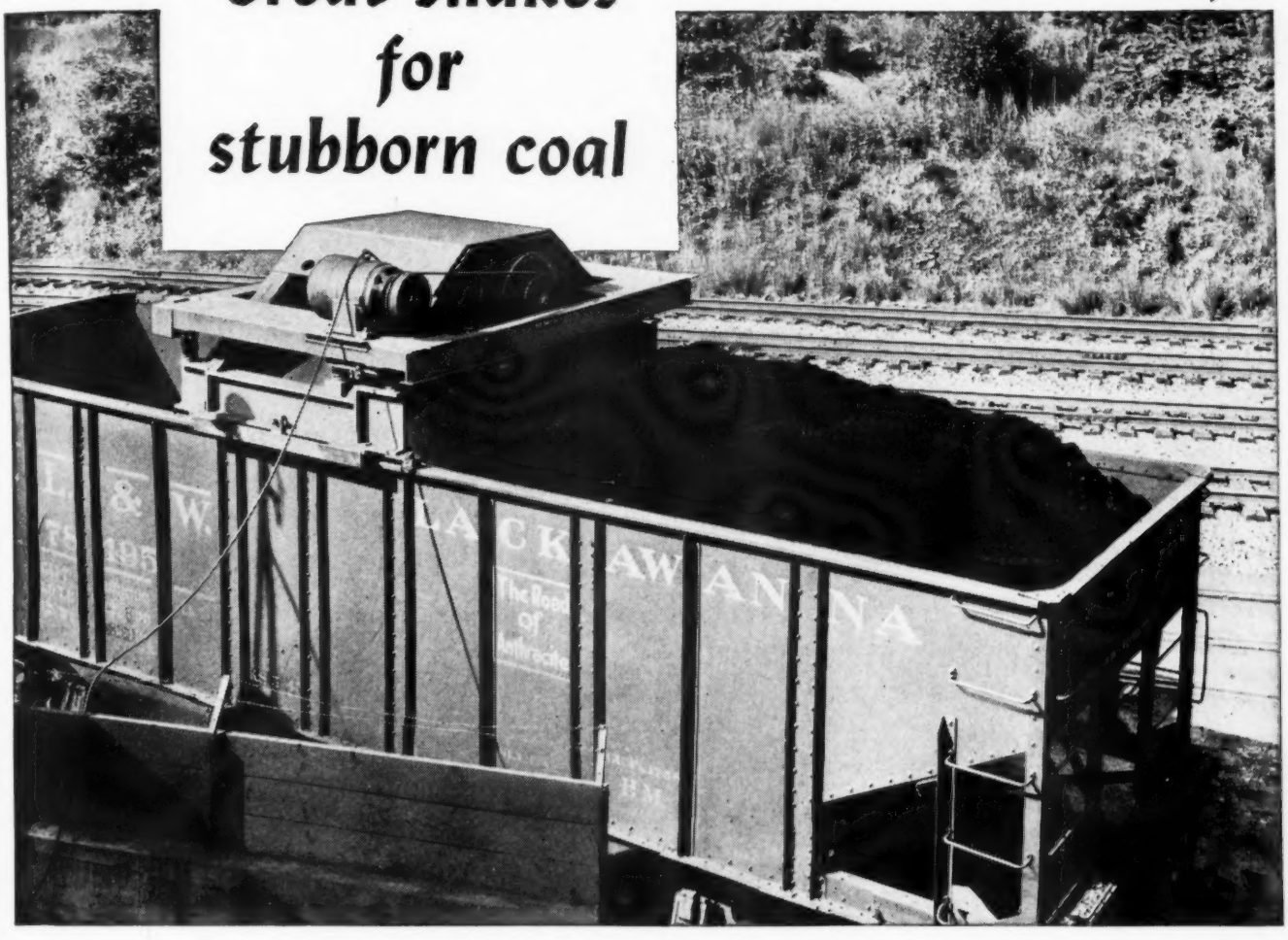
**56** **SMOKE INDICATOR**—Ess Instrument Co, 96 S Washington Ave, Bergenfield, N. J. Bulletin No. 580-C gives features of Ess smoke indicator SGL-JS.

**57** **RECORDING INSTRUMENTS** — Bristol Co, Waterbury 91, Conn. Bulletin No. W1811 lists recording thermometers, pyrometers, pressure gages, voltmeters, ammeters and pH recorders. Also listed are recording controllers, indicating controllers, miscellaneous instruments and accessories.

**58** **VENTURI TUBES AND NOZZLES** —Simplex Valve & Meter Co, 6780 Upland St, Philadelphia 42, Pa. Bulletin No. 450 describes construction and installation details of Type TG insert venturi tubes and nozzles.

**59** **FLOWMETER AND FUEL CONDITIONER** — Commercial Research Laboratories, Inc, 20 Bartlett Ave, Detroit 3, Mich. Bulletin No. 876 discusses Type 10 flowmeter for measurement of smaller fluid flow rates in laboratory and industry. Bulletin also describes Cox Type 6 automatic fuel conditioner, designed to insure maximum operating efficiency of Cox fluted guide flowmeter.

# Great shakes for stubborn coal



***Funny thing about coal.*** Send it on a train trip and it often gets stubborn about getting off the car.

Reason is that it settles during the trip—packs so tightly it won't flow out of the hoppers. Usually several men are needed to free the coal with sledges, pick axes and shovels.

This takes time—*lots* of it. It costs money! It ties up men, tools and cars . . . often a whole train, from engine to caboose. The same thing is true about unloading coke, ore, minerals and similar materials.

Couldn't something be done to break this bottleneck? Hewitt-Robins engineers set out to find a way. What they found is *great shakes for stubborn coal.*

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**The Robins Car Shakeout is only one in a long list of products "Job-Engineered" by Hewitt-Robins—including materials handling equipment and hose, belting, and other industrial rubber products. Together, Hewitt Rubber and Robins Conveyors bring you a total of 138 years of combined experience.**

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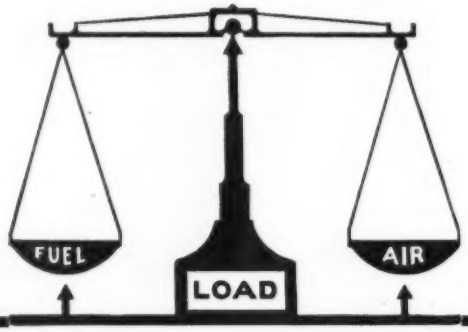
# *DEMAND*
# INCREASED BOILER EFFICIENCY!

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3. Metered control systems for oil, gas and coal.
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**60 PARABOLIC FLUMES** — Simplex Valve & Meter Co, 6780 Upland St, Philadelphia 42, Pa. Bulletin No. 210 covers calibration, construction, installation and capacity of Simplex Type S parabolic flumes.

## PIPING, FITTINGS, VALVES AND SPECIALTIES

**61 STEAM TRAPS** — Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 16-page bulletin No. T-1739 gives construction, operation, installation and application of Yarway steam traps.

**62 AIR-RELEASE VALVES**—Simplex Valve & Meter Co, 6780 Upland St, Philadelphia 42, Pa. Bulletin No. 140 describes operation, construction and essential requirements of air-release valves.

**63 STEAM TRAPS**—W S Rockwell Co, 200 Eliot St, Fairfield, Conn. Bulletin No. 428 describes construction of Rockwell steam traps.

**64 VALVES**—Ohio Injector Co, Wadsworth, Ohio. 248-page catalog is crammed with facts and specifications on steel, iron and bronze valves.

**65 AIR HOSE**—B F Goodrich Co, Akron, Ohio. 4-page catalog section No. 3460 describes construction and advantages of each air hose, outlines applications for which it is especially suited and gives data on sizes, braids and plies, pounds for 100-ft lengths, etc.

**66 SELF-CLEANING STRAINERS** — Elliott Co, Jeannette, Pa. 4-page bulletin No. A-12 discusses Type K self-cleaning strainers, which are recommended for service where a large amount of dirt or foreign matter is to be removed from water.

**67 AIR-INLET VALVES** — Simplex Valve & Meter Co, 6780 Upland St, Philadelphia 42, Pa. Bulletin No. 125 contains facts needed to put air-inlet valves into use as protection against collapse of thin-walled gravity-flow pipelines.

**68 STAINLESS-STEEL TUBING** — Babcock & Wilcox Tube Co, 85 Liberty St, New York 6, N. Y. Bulletin No. TB-323 outlines some of the applications of B & W stainless tubing.

**69 FLEXIBLE METAL HOSE** — Chicago Metal Hose Corp, Maywood, Ill. Catalog No. G-47 discusses various products made by the company. This catalog presents Flexonics, which is defined as "the science of controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion." Flexonics, a newly coined word, has particular reference to art of manufacturing flexible metal hose.

## PRIME MOVERS AND ACCESSORIES

**70 DIESEL ELECTRIC SETS**—Caterpillar Tractor Co, Peoria 8, Ill. 8-page booklet, Form No. 9895, outlines varied applications of diesel electric sets and reasons for such usage.

**71 DIESEL POWER**—Enterprise Engine & Foundry Co, San Francisco 10, Calif. 16-page booklet, entitled "Enterprise Turbocharging Multiplies Diesel Power," tells all about Enterprise diesels.

**72 DIESEL POWER**—Caterpillar Tractor Co, Peoria 8, Ill. 20-page booklet, Form No. 9778, entitled "Caterpillar Diesels at Work in Industry," stresses use of diesel-powered tractors on endless tasks that require mobile, flexible power around industrial plants. Booklet is full of action photos to illustrate its text, and pictures and text combine to suggest many ways possible to make use of diesel power.

## PUMPS

**73 CENTRIFUGAL PUMPS**—Deming Co, 203 Broadway, Salem, Ohio. 16-page bulletin No. 4013-A explains details of design, construction and operation. Performance tables for all motor-driven and belt-driven pumps simplify selection.

**74 PLUNGER PUMPS** — Worthington Pump & Machinery Corp, Harrison, N. J. 6-page bulletin No. W-412-B30A describes features, specifications, installations and dimensions of Types KLF-KMF duplex double-acting plunger pumps.

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*Specialized Industrial Cleaning*
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**75** **CENTRIFUGAL PUMP**—Byron Jackson Co, Box 2017 Terminal Annex, Los Angeles 54, Calif. 12-page bulletin No. 46-6000 on the Hydropress pump covers technical data, application pictures, cross-section drawings of parts, operation and design features, etc.

**76** **ROTARY PUMPS** — Worthington Pump & Machinery Corp, Harrison, N. J. 6-page bulletin No. W-487-B10B presents Type GR heavy-duty rotary pumps. These pumps handle liquids comparatively free from abrasive or corrosive substances.

**77** **CENTRIFUGAL PUMPS** — Warren Steam Pump Co, Warren, Mass. 4-page bulletin No. 225 describes Warren Type DB and DBM single-stage double-suction centrifugal pumps.

**78** **ROTARY PUMPS** — Worthington Pump & Machinery Corp, Harrison, N. J. 8-page bulletin No. W-484-B1 discusses specifications and dimensions of Worthington Type GA rotary pumps.

**79** **BOILER FEED PUMPS**—Deming Co, Salem, Ohio. 24-page bulletin No. CR-1 explains complete Deming line of boiler feed pumps and condensation return units.

**80** **PORTABLE JET PUMPS**—Jet Pump Div. Derbyshire Machine & Tool Co, 5249 Belfield Ave, Philadelphia 44, Pa. Catalog No. 315 features a simple method of determining correct jet pump for the user's individual requirements.

**81** **PUMPS AND WATER SYSTEMS**—Deming Co, Salem, Ohio. 180-page catalog No. G-47 discusses several new lines of Deming pumps. First 86 pages cover industrial lines of pumps, including centrifugal pumps, sump pumps, cellar drainers, deep-well turbine pumps, high-pressure pumps, condensation return units, boiler feed pumps, mine pumps, Triplex pumps, Turbo-Flo pumps and rotary pumps. Balance of catalog is on water systems for domestic and farm use, pump accessories and spray pumps.

## WELDING

**82** **MOTOR-OPERATED FLASH WELDERS**—Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. Bulletin No. 204 describes improved line of motor-operated flash welders. The machines are available also as storage battery operated units.

**83** **WELDING PROCEDURES** — Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. Two new procedure sheets tell how to weld malleable iron and cast iron, featuring use of Ampco-Trode coated aluminum-bronze electrodes and Phos-Trode shielded-arc phosphor-bronze electrodes.

**84** **RESISTANCE WELDING CONTROL** —Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa. 18-page booklet No. B-3839 describes Synchro-Trol, a new line of synchronous-precision ac resistance welding controls in a complete, unified, factory-assembled package. Booklet also discusses company's complete line of nonsynchronous controls, known as Weld-O-Timer, that makes available any desired combination for sequencing and timing.

**85** **ARC WELDERS**—Hobart Bros Co, Hobart Sq. Troy 1, Ohio. Booklets J-1660 and J-1742 feature Hobart arc welders. Booklet J-1741 lists Hobart arc-welding accessories and arc-welding textbooks. It also tells about Hobart school of arc welding.

**86** **WELDING DIES**—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. Two new procedure sheets discuss welding of dies. The first gives correct methods of arc welding composite dies while the second covers aluminum bronze die repairs. These sheets recommend electrodes, correct polarity and currents, amperage and voltage, necessary preparation, etc.

**87** **ARC WELDING** — Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y. 4-page pamphlet, entitled "Arc Welding at Lower Base Metal Temperatures," gives essential information on development, advantages, applications, etc. of flux-coated rods for arc welding all metals.

**88** **ARC WELDING**—Registrar, Hobart Trade School, Inc, Troy, Ohio. 24-page publication, entitled "Learn Arc Welding," explains functions and courses of study pursued at Hobart Trade School.


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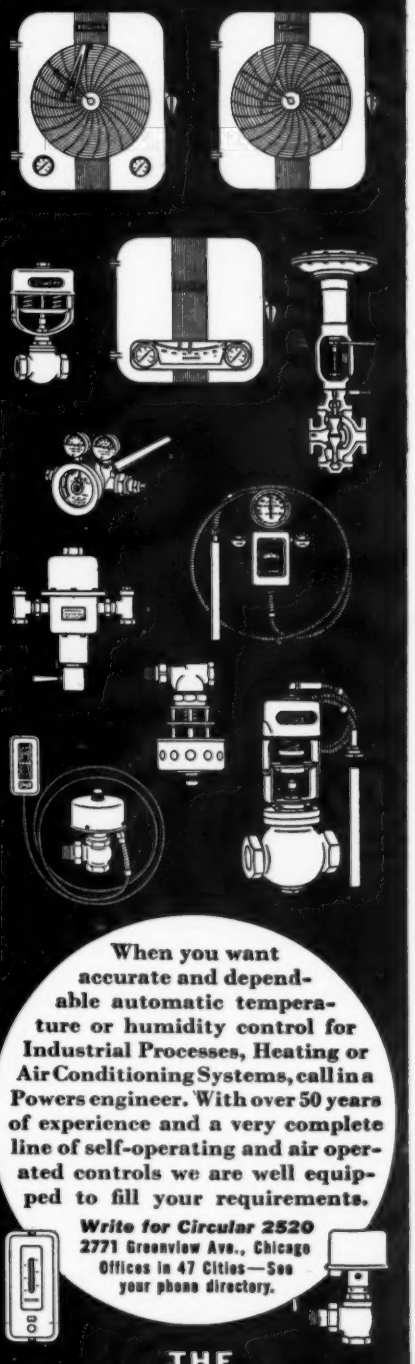
TEMPERATURE and HUMIDITY CONTROL



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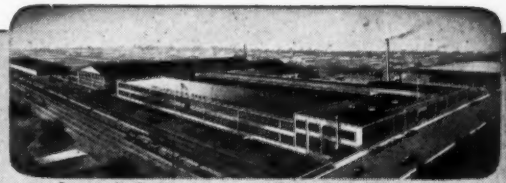

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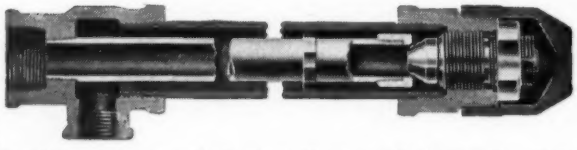
## with Nicholson Expansion Traps

*Quiet Operation Is a Feature of These "Continuous Discharge" Steam Traps*



Elimination of violent-acting traps is a No. 1 measure in anti-noise campaigns. Due to their "continuous discharge" action, Nicholson expansion steam traps are extremely quiet. And they are entirely automatic; no air binding; no freeze-ups; discharge air as efficiently as water.

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# Prevent DRY PUMP OPERATION

*with the New*

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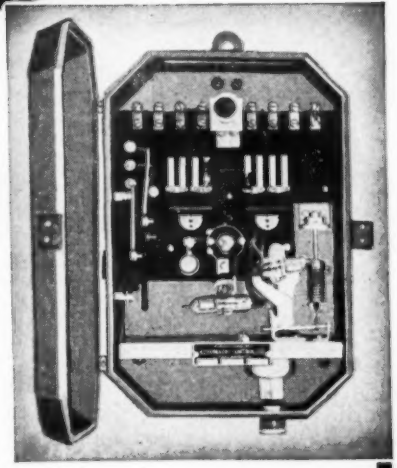

If your primary control calls for pump operation, and water is not discharged, —PROTECTROL stops the pump, locks out the starter until PROTECTROL is manually reset. It also rings alarm bell and lights warning signal. It prevents damage to bearings and excessive wear caused by running the pump dry. PROTECTROL can be used with any make of pump or automatic control. PROTECTROL is better than an insurance policy,—it prevents damage before it occurs. Write for Bulletin T-1130. State your requirements and engineering data will be furnished.

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**AUTOMATIC CONTROLS** are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.


### WATER TREATMENT

**89** **LIQUID CONDITIONING** — Liquid Conditioning Corp, 114 E Price St, Linden, N. J. 8-page condensed catalog gives concise information on methods and equipment for water treatment, purification of process liquids and recovery of valuable substances from waste liquids.

**90** **ION EXCHANGE AND SILICA REMOVAL PLANT** — Belco Industrial Equipment Div, Bogue Electric Co, Paterson 3, N. J. 8-page booklet describes the semiautomatic ion exchange and silica removal plant that Belco is building for Dow Chemical Co at Midland, Mich.

**91** **CORROSION PREVENTION**—E F Drew Co, 15 E 26th St, New York 10, N. Y. 12-page reprint, entitled "Corrosion of Plant Equipment by Steam and Water," by Dr. R C Ulmer, gives theory, characteristics, effects of corrosion, causes, methods employed for preventing corrosion and embrittlement, etc. Bulletin No. 1/25/46-RCU (Revised 3/10/47-RCU) discusses Ameroid steam-line corrosion control.

**92** **WATER SOFTENERS**—Liquid Conditioning Corp, 114 E Price St, Linden, N. J. 8-page bulletin No. 5 describes sodium and hydrogen zeolite water softeners and demineralizers. Bulletin covers various Liquonex cation-exchange materials.

**93** **BOILER WATER-LEVEL CONTROL** — Northern Equipment Co, Erie, Pa. 8-page bulletin No. 465 discusses boiler water-level control at West Reading Station, Metropolitan Edison Co.

**94** **WATER TREATMENT** — American K A T Corp, 331 Madison Ave, New York 17, N. Y. A series of engineering data sheets cover a particular phase of water treatment, such as scale, corrosion, after treatment and colloids. Sheets show how organic-colloidal treatment and inorganic-chemical methods apply to various phases and problems of water treatment.

**95** **BOILER WATER-LEVEL CONTROL** —Northern Equipment Co, Erie, Pa. 8-page bulletin No. 467 describes boiler water-level control at Buzzard Point Plant of Potomac Electric Power Co.

**96** **WATER TREATMENT** — Water Treatment Div, Magnus Chemical Co, Garwood, N. J. 40-page manual on Magnus method of boiler feedwater treatment is divided into three sections. Section 1 outlines theoretical basis of modern boiler feedwater treatment. Section 2 contains full instructions on the making of the tests. Section 3 contains practical data applying not only to control of boiler feedwater, but to many other factors involved in operation of a steam boiler installation.

**97** **SILICA REMOVAL**—Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J. Bulletins No. 6 and 7 give effective methods of removing iron, manganese and silica from water supply.

**98** **COLLOIDAL WATER CONDITIONING**—American K A T Corp, 331 Madison Ave, New York 17, N. Y. 4-page reprint describes K A T colloidal water conditioning and case history of its application in power plant of U. S. Military Academy, West Point, N. Y.

### OTHER EQUIPMENT

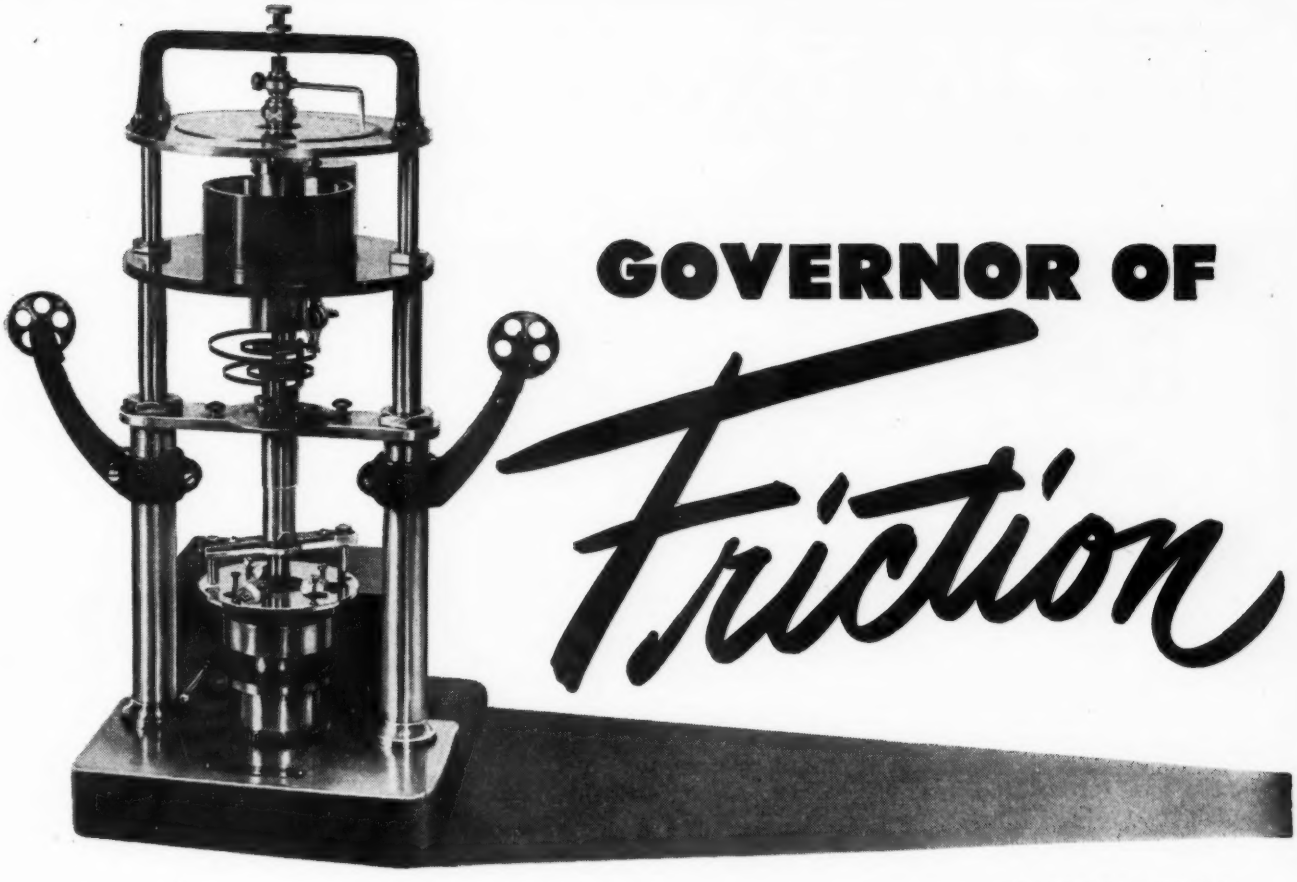
**99** **AIR COMPRESSORS** — Worthington Pump & Machinery Corp, Harrison, N. J. 4-page bulletin No. H-820-B26 covers capacities, rating, specifications and dimensions of Air King compressors.

**100** **AFTERCOOLERS** — Worthington Pump & Machinery Corp, Harrison, N. J. 8-page bulletin No. L-802-B2 discusses aftercoolers for air and gas.

**101** **ELECTRIC HOISTS**—Whiting Corp, Harvey, Ill. 8-page bulletin No. H-100A describes operation and gives complete specifications, speeds, prices, etc, of one-quarter, one-half and one-ton hoists.

**102** **PERMANENT MAGNETIC SEPARATORS**—Homer Mfg. Co, 436 N Main St, Lima, Ohio. 4-page folder shows typical Homer permanent magnetic separator applications for various industries.

**103** **DUST CONTROL** — American Air Filter Co, 215 Central Ave, Louisville 8, Ky. 19-page booklet covers Type D Roto-Clone dynamic precipitator, a device adapted to dry collection of granular industrial dust.



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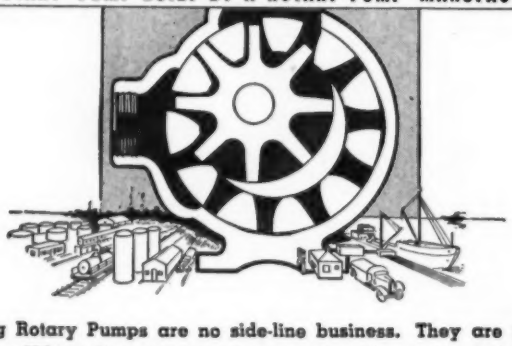
WAYNESBORO, PENNA. U.S.A.

VIKING

The ROTARY PUMP BUILT BY A ROTARY PUMP MANUFACTURER



Viking Rotary Pumps are no side-line business. They are no fill-in. Making Viking Rotary Pumps is our one and only job. That is why you get so much from a Viking Pump.

It's an exclusive Viking product . . . in design . . . in production . . . in service. Every effort is extended toward the betterment of this one product. Every design is based on a "gear-within-a-gear—2 moving parts" principle. All production is concentrated on this one style pump. Service is simplified by the same means.

Discover for yourself this outstanding rotary pump. Write today for free folder Bulletin Series 47SW. It will be sent to you by return mail.

VIKING PUMPS FIRST IN AMERICA

See Our Catalog In SWEETS

VIKING Pump COMPANY CEDAR FALLS, IOWA

## Reader's Problems

(*Continued from page* 113)

the shutoff valve is not subject to wear, and also that it tends to increase blowdown effectiveness.

Shutoff valve *B* might be removed from the system entirely as in 1-*G*, p 113. This has the advantage of making the blowdown operation easier in the cramped space. But it has the obvious disadvantage of making boiler repairs more difficult.

*Auburn, N. Y.* T E Connor

### Valves Should Be Brought Together

Blowdown valve D in WJH's sketch should certainly be moved to the line between boiler No. 2 and the drain line common to both boilers. The present arrangement of valves constitutes a serious hazard; if boiler No. 1 is blown down while No. 2 is out for repairs, only the quick-opening valve *C* keeps hot water from entering the idle boiler. Quick-opening valve *C* will probably not be tight, and anyone working inside boiler No. 2 might be seriously scalded. It is best to have valves *A* and *B*, also *C* and *D*, as close together and as close to the boilers as possible.

*Yonkers, N. Y.* H H Poor

### Blowdown Separately

Valve arrangement in *WJH's* plant is definitely wrong. Valve *D* should be installed between *C* and the blowdown line. Also, both boilers should not be blown down at the same time, for if one boiler is steaming faster than the other, the unit steaming fastest will blow down more water because of a small increase in pressure.

As for blowdown sequence my idea is to open *B*, open *A* slowly, close *A*, close *B* slowly. Although some engineers do not agree with this method. I feel there is less chance of scale getting under or in the quick-opening valve when closing.

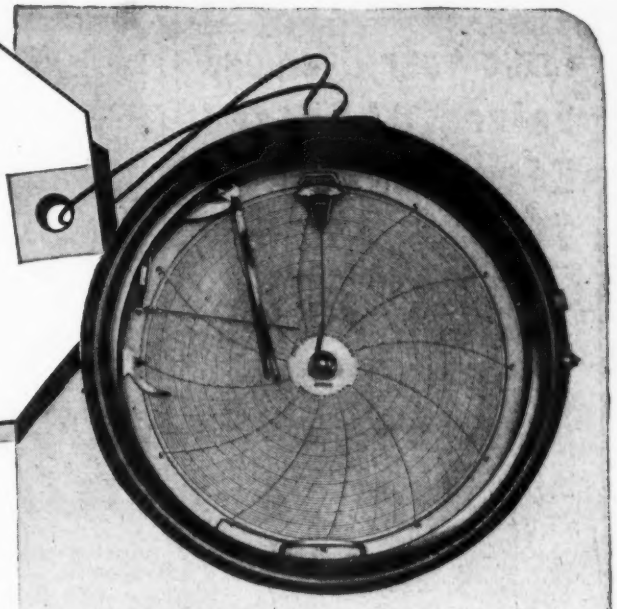
*Winona, Minn.* T A Muellerleile

---

**Westinghouse Electric Corp** provides compact high-quality meters with 250-deg scales to meet requirements of the Navy. Most significantly, however, it was found possible to use iron-core electromagnets instead of the conventional air-core type.

**Niagara Falls Power Co** will spend $2,670,900 on installation of five new 60-cycle ac generators and other equipment by the middle of the summer of 1949. They will replace five dc generators, now owned and used by Aluminum Co of America. In the same period, the company will retire $276,600 worth of machinery and equipment. The new generators will provide a 40,000-kw capacity. They should produce 300,000,000 to 350,000,000 kwhr over a period of a year. The company proposes to sell this entire output to the Buffalo-Niagara Electric Corp.

# Automatic Cure for Plugging of Travelling Intake Screens



**Simple FOXBORO Control System operates screen whenever suction level drops . . .**

HERE'S AN EASY, inexpensive way to make sure that your condenser well won't go dry if excessive refuse causes sudden plugging of the travelling screen.

Foxboro Travelling Screen Control supplements periodic screen-timing with a "judgment" that's almost human. By continuous measurement of water level on each side of the screen, this sensitive control system independently starts the cleaning action whenever a predetermined safe differential is exceeded. When correct levels are again restored, it automatically shuts down screen and spray motors. In case of unusually severe fouling of the screen, the controller can also operate a warning signal.

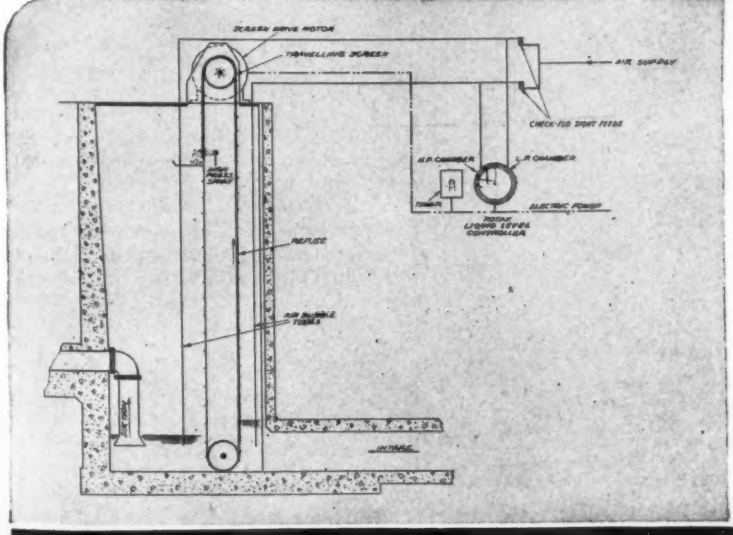
Write for complete information on Foxboro Travelling Screen Control and Bulletin 184-4 containing details of Foxboro Rotax Controllers. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

## ROTAX

### Liquid Level Controller

***The "heart"*** of Foxboro Travelling Screen Control. An extremely simple, positive-operating controller that translates level differential into operation of motors. In addition, it can operate a warning horn or light in case of unusually severe plugging.

***Exclusive Rotax features include:*** positive electrical contact; special lock-up circuit which eliminates chattering of control relays; constant brush pressures; self-cleaning platinum contact surfaces; easy setting of control point; and freedom from maintenance.




**SCHEMATIC DIAGRAM,** left, shows simplicity of Foxboro Travelling Screen Control System. Water level differential through the screen is continuously measured by bubble tubes. The Foxboro Rotax (electric) Controller starts and stops the screen and spray motors, as required to maintain safe differential.

FOXBORO
REG. U. S. PAT. OFF.

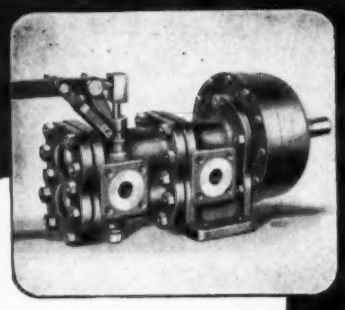
RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

## Make Your Overhead Valves SAFE and Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

**BABBITT STEAM SPECIALTY CO.**
New Bedford, Mass.





IMO reversible hydraulic motor permitting infinite speed variation in either direction.

**IMO POWER UNIT**

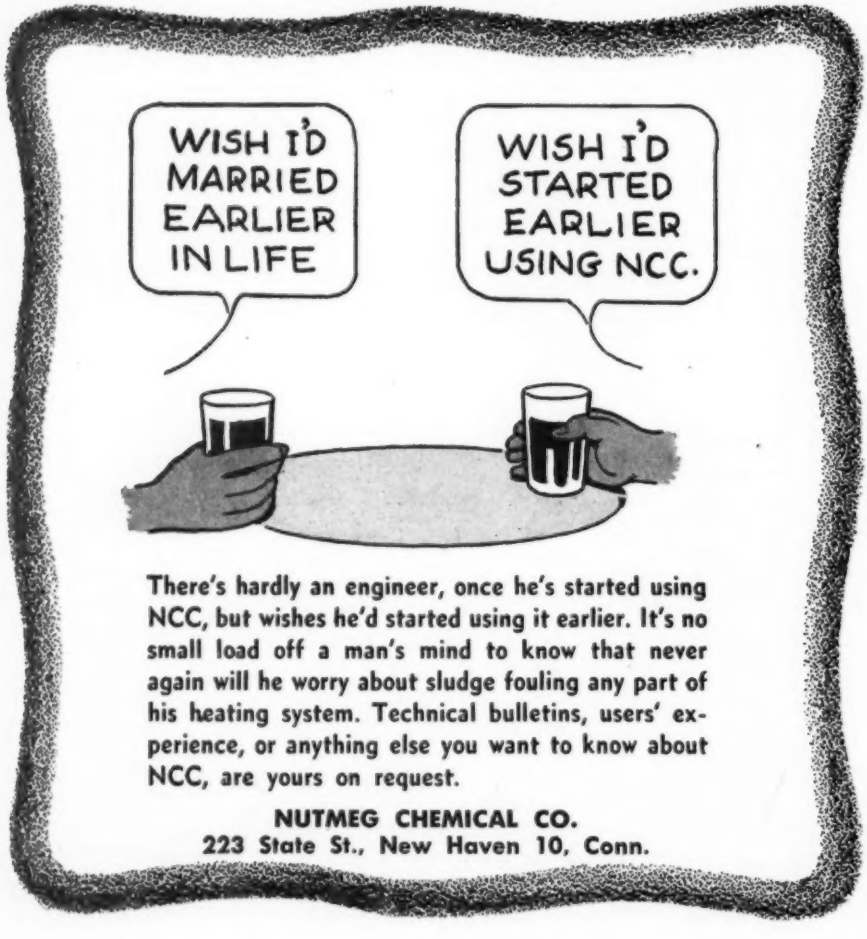
The IMO principle embodied in a hydraulic motor makes an exceptionally simple, compact and reliable device for hydraulic power transmission.

IMO hydraulic motors can be furnished for operation at varying speeds in either direction with corresponding variation in output.

*For information send for catalog I-130 P*

IMO PUMP DIVISION
of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY






There's hardly an engineer, once he's started using NCC, but wishes he'd started using it earlier. It's no small load off a man's mind to know that never again will he worry about sludge fouling any part of his heating system. Technical bulletins, users' experience, or anything else you want to know about NCC, are yours on request.

**NUTMEG CHEMICAL CO.**
223 State St., New Haven 10, Conn.


## Appointments

(*Continued from page* 186)

and to serve as a divisional branch for export sales and shipping dept. Organic and phosphate sales staff in the new office will be headed by Thornton Jesdale. Paul Huntington will have charge of alcohol and dry ice sales; Robert E Holmes will head export sales and shipping dept branch. The office will serve solely as a sales unit.

Walter P Berg has been named vice-president and member of board of directors of **Dravo Corp.** Daniel B Benscoter has been appointed district sales engineer for machinery div of Dravo Corp, which represents DeLaval Steam Turbine Co and which manufactures and markets Dravo Counterflo commercial and industrial space heaters. Benscoter's office will be in Southern Ohio Bank Bldg, Cincinnati. His district, covering Ky. and southern Ohio and Ind., is part of Dravo's Cleveland region.

**Chelsea Products, Inc,** appointed George Read general manager.

C W Main has been made a field representative of **Plomb Tool Co.** His headquarters are in Denver and his territory includes Colo., Wyo., and parts of S. D. and Neb.

**Raybestos-Manhattan, Inc,** made following changes: John H Matthews was elected vice-president in charge of Manhattan Rubber Div, Passaic, N. J. O H Cilley, assistant general manager of U. S. Asbestos Div, was made a vice-president. A F Heinsohn, general manager of General Asbestos and Rubber Div, North Charleston, S. C., was placed on new board of directors.

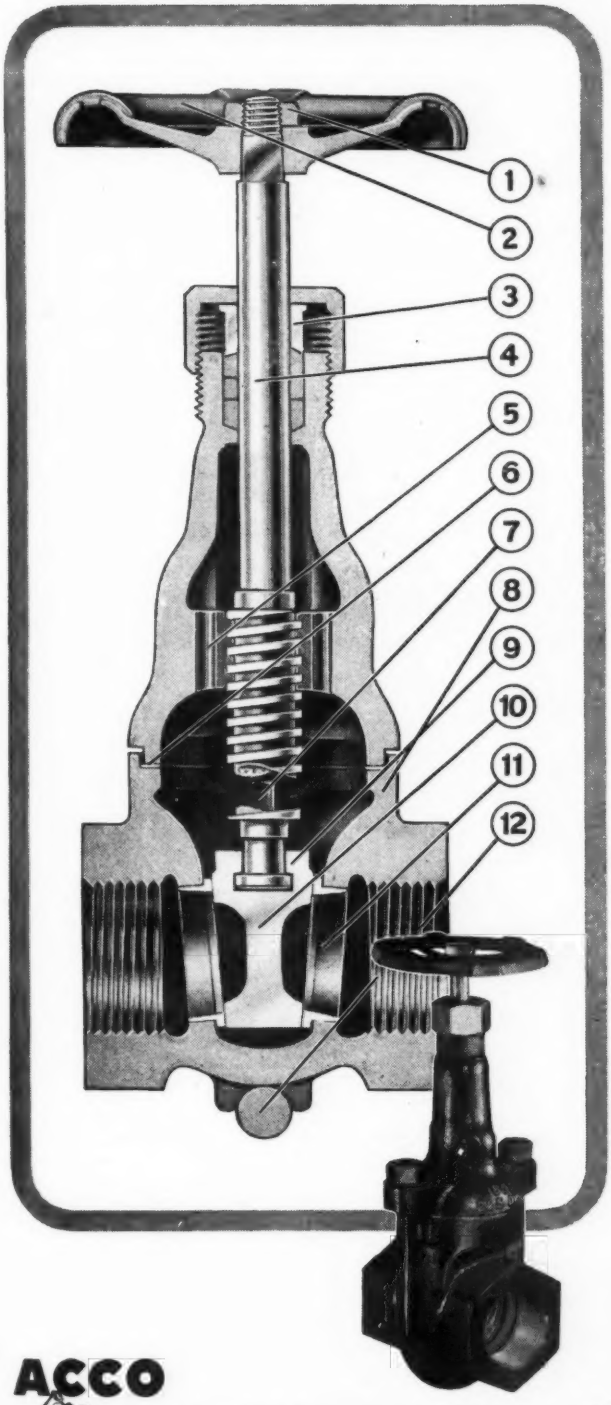
New offices and warehouse facilities for **Raybestos-Manhattan, Inc,** have been occupied at 131 Mission St, San Francisco. Manhattan Rubber Div announced that Asbestos Co of California, 941 16th St, San Francisco, will represent them in that area.

**Eastern Industries** has purchased buildings, machinery and production rights of McIntyre Co, Newton, Mass. It will be known as McIntyre Div, Eastern Industries, Inc.

Paul H Holton has been named manager of **Carboloy Company's** Atlantic district office, at 1060 Broad St, Newark, N. J. Holton succeeds T D MacLafferty who resigned. Paul Schick has been appointed to succeed Holton at Philadelphia branch.

**A P Green Fire Brick Co** announces reorganization of management control: (1) Herbert B Plunkett becomes director of sales, which includes both domestic and export operations. (2) Arthur D Bond will be director of affiliate and subsidiary com-

# TODAY'S CLIP GATE VALVE BY READING-PRATT & CADY




**Quick cleanout a *plus* feature of this good, tight, sturdy gate valve. Made of close-grained Hi-Test Gray Iron—50% stronger than ordinary iron.**

1. Heavy wheel nut
2. Kool-grip malleable iron ventilated hand-wheel
3. Deep stuffing box with follower. Can be packed under pressure
4. Stem gray iron or bronze rod stock. Bronze bushing cast in
5. Full, adequate bonnet drain prevents possible trouble from freezing in outside installations
6. Male and female bonnet joint with asbestos gasket
7. Fully-machined wedge guides in body
8. Body and bonnet of close-grained Hi-Test Gray Iron—50% stronger than ordinary iron
9. Horseshoe type slip-on connection
10. Heavy cast I-beam wedge—reversible and renewable. Wedge rises above flow when open
11. Rolled-in seat ring (in bronze-mounted type)
12. Full U-bolt in closed bolt holes. Held in place by 3 sets of lugs on body

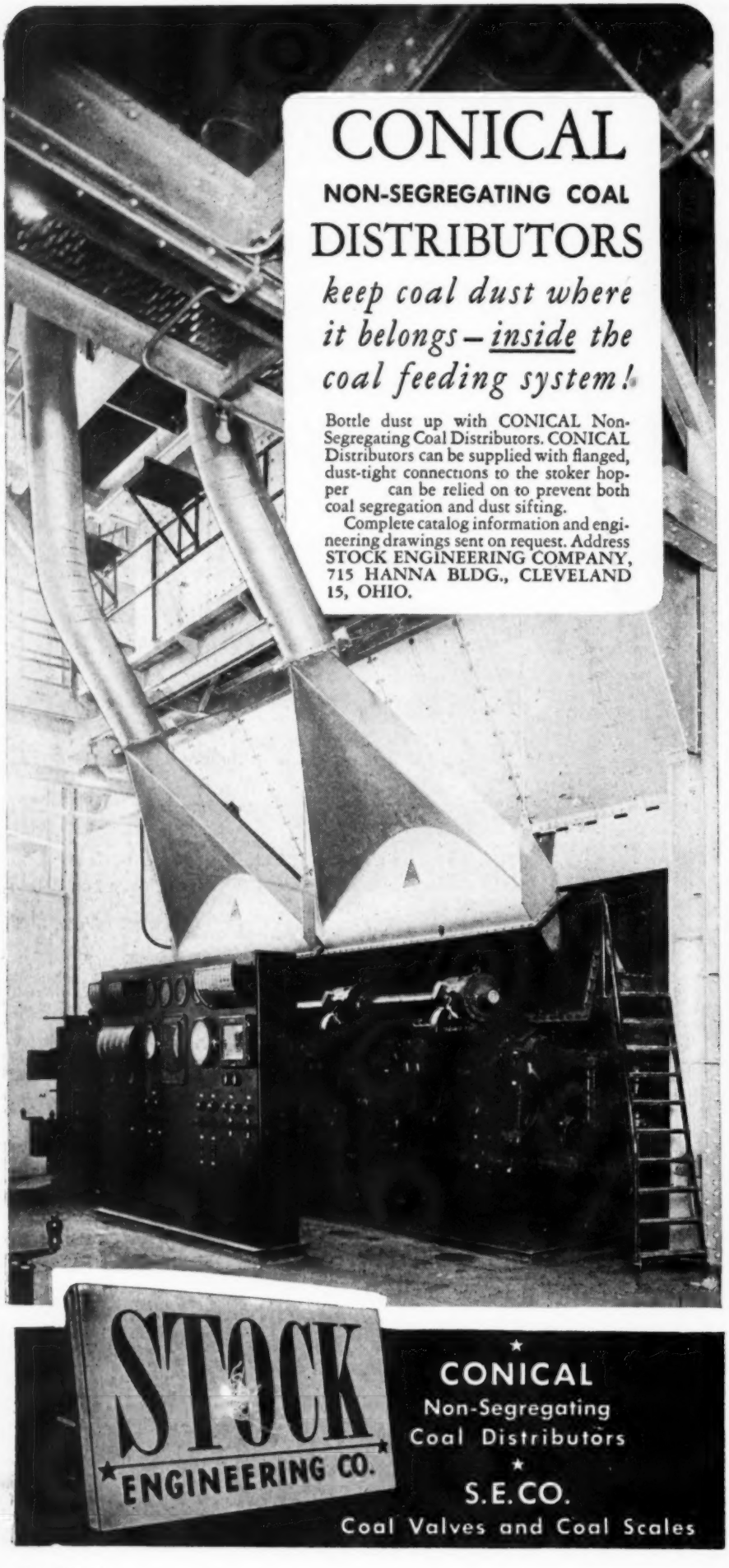
All iron or iron body, bronze mounted. Sizes ½" to 3". Rated 150# steam, 250# O.W.G. Ask your Reading-Pratt & Cady Distributor about Clip Gate Valves. Distributors in principal cities.

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK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NON-SEGREGATING COAL
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keep coal dust where it belongs—inside the coal feeding system!
Bottle dust up with CONICAL Non-Segregating Coal Distributors. CONICAL Distributors can be supplied with flanged, dust-tight connections to the stoker hopper can be relied on to prevent both coal segregation and dust sifting.
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ENGINEERING CO.
CONICAL
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Coal Distributors
S.E.CO.
Coal Valves and Coal Scales

panies, both domestic and foreign. (3) Lester J Miller becomes director of manufacturing. (4) Neal S Wood will be director of procurement and properties. (5) D H Kreutzer will be director of finance. (6) Walter G Staley becomes director of industrial relations.

C C Chamberlain has been elected a vice-president of **Jenkins Bros.**

**Maguire Machinery Co,** 330 W 42nd St, New York, N. Y., has been organized to engage in designing, manufacturing and selling of power conveyors and dairy machinery. The lines of equipment formerly handled by machinery div of Walter Maguire Co will be taken over by this new firm.

Frank E Lobaugh has been appointed technical service director of Lumnite div, **Universal Atlas Cement Co.**

Lester O Stearns has joined **York-Shipley, Inc,** as manager of residential div. Stearns will supervise all sales of residential and commercial oil-fired equipment and will continue to enlarge York-Shipley's distributor and dealer organization.

**Eaton Mfg Co** has added John C Virden and Martin P Winther as directors.

Robert E Cryor has been elected a vice-president and director of **Union Asbestos & Rubber Co.** Other additions to board of directors included A A Halle Jr, Hugo Anderson and Hugo Sonnenschein.

**National Supply Co** appointed A B Reese Jr regional sales manager of Superior Engine Div at Fort Worth, Tex.

Chester A Roush Jr became associated with **Edgar A Rogers,** Chattanooga Bank Bldg, Chattanooga, Tenn. Rogers represents Mixing Equipment Co; Merrick Scale Mfg Co; LaBour Co; Process Equipment Div of Lapp Insulator Co; Foster Engrg Co; Pennsylvania Pump & Compressor Co; Thermix Corp; Black, Sivalls & Bryson; Helicoid Gage Div of American Chain & Cable Co.

C H Stanton has been appointed assistant manager of the **Orlando, Fla.,** utility system.

**Brockton (Mass.) Edison Co** named A Scudder Moore general superintendent.

William R Wise has been appointed superintendent of **N. Y. State Electric & Gas Corp's** steam-generating station now under construction at East Corning. Wise will be succeeded by A Nelson Bradford, as chemist and test engineer at company's Dresden Station.

R L Hearn of Niagara Falls, Ont., has been named manager of **Ontario Hydro Commission** by provincial government and also will fill position of chief engineer.

**American Society of Tool Engineers** elected following officers: *President*—W B Peirce, vice-president in charge of research, Flannery Bolt Co, Bridgeville, Pa. *First*

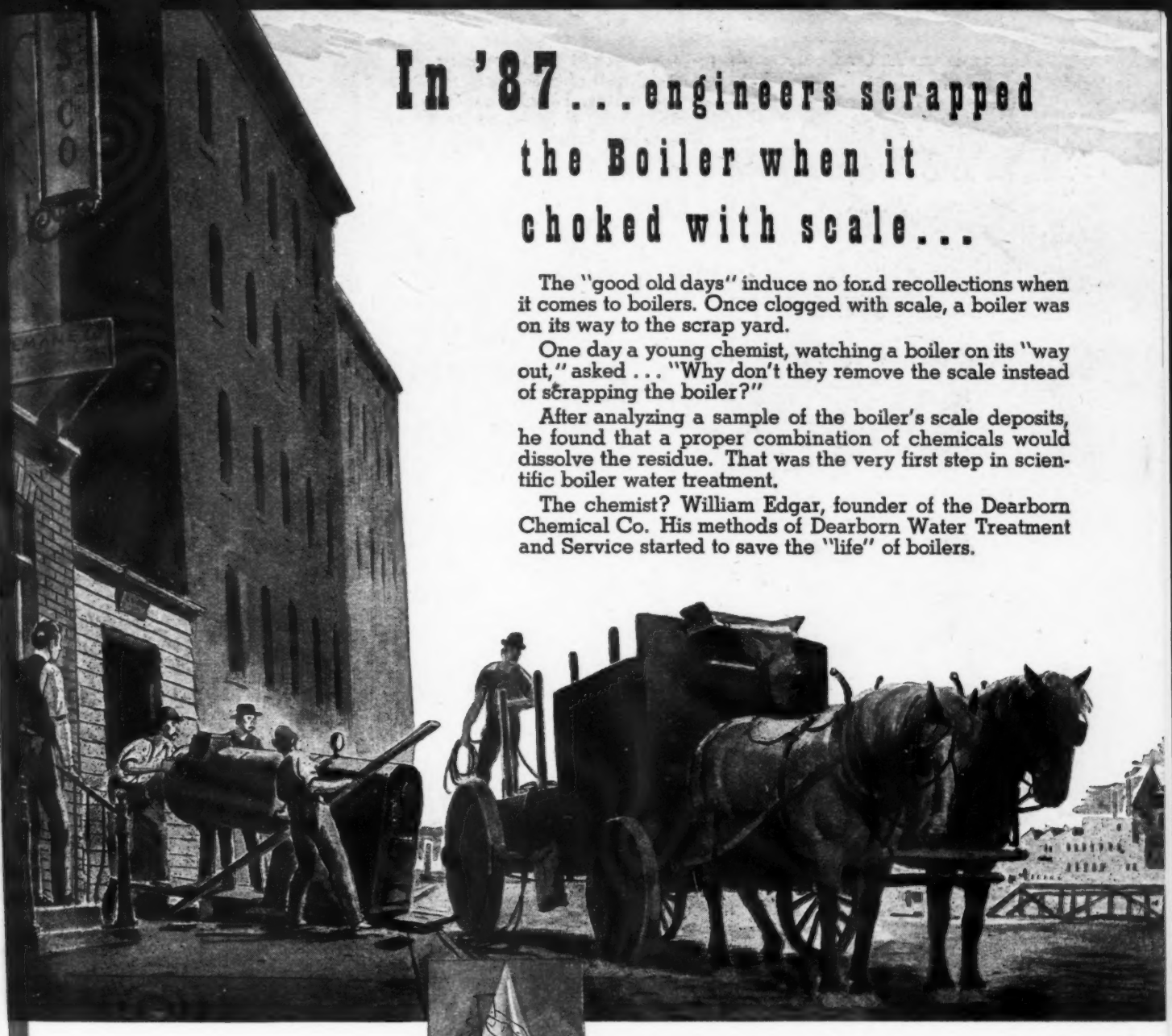
# In '87 . . . engineers scrapped the Boiler when it choked with scale . . .

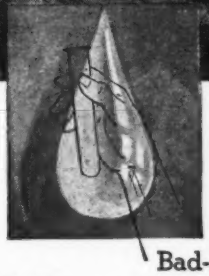
The "good old days" induce no fond recollections when it comes to boilers. Once clogged with scale, a boiler was on its way to the scrap yard.

One day a young chemist, watching a boiler on its "way out," asked . . . "Why don't they remove the scale instead of scrapping the boiler?"

After analyzing a sample of the boiler's scale deposits, he found that a proper combination of chemicals would dissolve the residue. That was the very first step in scientific boiler water treatment.

The chemist? William Edgar, founder of the Dearborn Chemical Co. His methods of Dearborn Water Treatment and Service started to save the "life" of boilers.





# . . . in '47 engineers get rid of the Scale and save the Boiler!

Walk through Dearborn Laboratories today and it is hard to realize that dissolving residue in boilers with chemicals was once a "pioneer" idea. Saving the boiler is now a vast scientific procedure.

Bad-acting water samples from all parts of the country pour in for analysis under Dearborn scientific technique. Plant operating conditions are surveyed; corrective treatment programs mapped out; proper feeding equipment is installed. The boiler of today, thanks to Dearborn, is assured of its full quota of boiler-years . . . free from scale, corrosion, any water-hazard that hampers the efficient production of clean steam.

ESTABLISHED IN '87

EXPLORING NEW HORIZONS IN '47

**Dearborn**

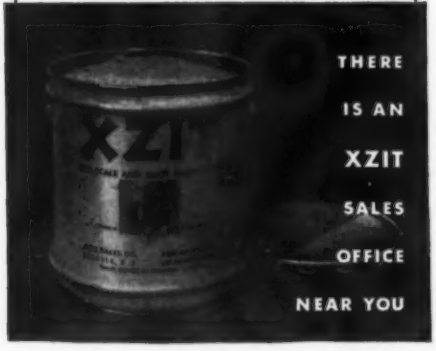
TRADE MARK REGISTERED

**"THE LEADER FOR 60 YEARS"**

**ENGINEERING SERVICE AND WATER TREATMENT**

Dearborn Chemical Company
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.
New York, Los Angeles, Toronto

REMOVE SOOT
and firescale with **XZIT**
from all boiler surfaces—
tubes, walls and stacks.
**XZIT** Firescale and Soot
Eradicator saves fuel by
improving heat transfer.
**XZIT does its work**
**while boilers operate.**
Simply feed **XZIT**
into the firebox.
When touched by flame,
**XZIT** forms a gas
which permeates all parts of
boiler and removes
soot and firescale.
Regular use of
**XZIT keeps boilers & stacks**
**free of soot & firescale.**
Ask for a demonstration or
order a trial supply.




**XZIT**
**FIRESCALE & SOOT ERADICATOR**
**5800 S. Hoover St., Los Angeles, Calif.**
**158 14th St., Hoboken, New Jersey**

*Vice-President*—I F Holland, general superintendent, small tool and gage dept, Pratt & Whitney Div, Niles-Bement-Pond Co, Hartford, Conn. *Second Vice-President*—R B Douglas, industrial engineer, Montreal, Que., Can. *Third Vice-President*—George C Johnson, chief engineer, W F and John Barnes Co, Rockford, Ill. *Secretary*—W A Dawson, branch manager, F F Barber Machinery Co, Hamilton, Ont., Can. *Executive Secretary*—V H Ericson, vice-president, Johnson-de Vou, Inc, Boston, Mass.

William I Kierstead has been appointed assistant chief engineer of Mason steam plant of **Central Maine Power Co** at Wiscasset.

Frederick G Hughes, vice-president of **General Motors** and general manager of its New Departure Div, at Bristol, Conn., retired after 36 years of association with New Departure.

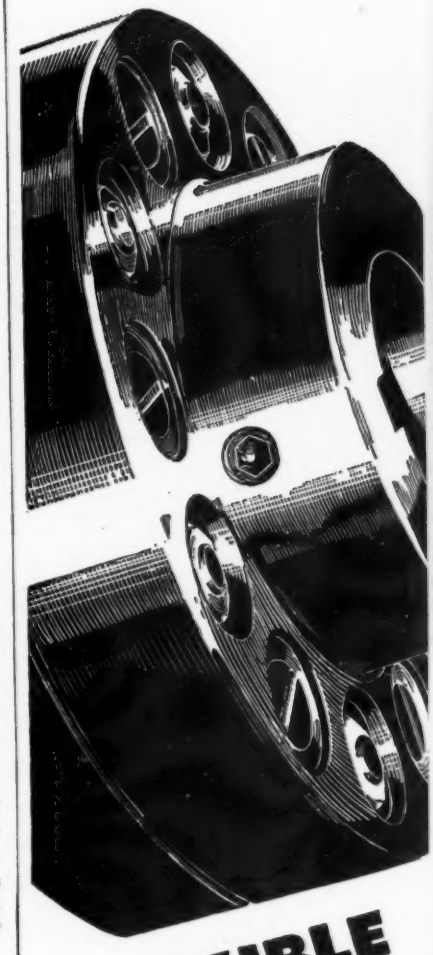
William V Kahler, vice-president, Illinois Bell Telephone Co, has been elected president of **Western Society of Engineers** for the year 1947-48. Verne O McClurg, consulting engineer, firm of Mundie-Jensen-McClurg, becomes first vice-president. Gustav Egloff, director petroleum technology, Universal Oil Products Co, was made vice-president and M W Casad, plant extension engineer, Illinois Bell Telephone Co, was reelected treasurer. Leigh S Keith and Bolton G Anderson remain as secretary and assistant secretary, respectively.

**Refrigeration Equipment Manufacturers Assn** elected following officers: *President*—E M Flannery, *vice-president*, Bush Mfg Co, Hartford, Conn. *Vice-President*—H F Hildreth, sales manager, refrigeration specialties div, Westinghouse Electric Corp, Springfield, Mass. *Treasurer*—R H Israel, sales manager, Virginia Smelting Co, West Norfolk, Va. *Secretary*—K B Thorndike, vice-president, Detroit Lubricator Co, Chicago.

Dr P J Selgin has been appointed to staff of **National Bureau of Standards.** Dr Selgin will work on development of electronic ordnance for the military services in ordnance development div. Donald I Graham Jr has been made safety director of Bureau and chief of safety section.

Frank T Ward, vice-president and chief engineer of Third Ave Transit Corp, New York, N. Y., has been elected chairman and Frank O Hoagland, vice-president, Pratt & Whitney Div, Niles-Bement-Pond Co, Hartford, Conn., has been made vice-chairman of Mechanical Standards Committee of **American Standards Assn.** In addition to Ward and Hoagland, new members of the Executive Committee are: (1) D E Batesole, chief engineer, Norma-Hoffmann Bearing Corp, Stamford, Conn., representing Society of Automotive Engineers (2) L W Kattelle, assistant chief engineer, Walworth Co, New York, N. Y., representing Manufacturers Standardization Society of the Valve and Fittings Industry (3) John R Kruse, chief engineer, Combustion Engrg Co, New York, N. Y., representing American Society of Mechani-

AJAX



**FLEXIBLE COUPLINGS**
Protect direct-connected machines from unavoidable misalignment. No lubrication, no noise. Write for data book.
AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, NEW YORK

# HOW TO BUY *Maximum* ANTI-FRICTION PERFORMANCE IN A COMPRESSOR

*Ingersoll-Rand portable air compressors and wagon drills — all Timken Bearing Equipped — engaged on a road job.*

If you merely specify anti-friction bearings you may or may not get the performance you are expecting. It all depends on the bearings themselves.

To be sure of getting anti-friction bearing advantages in full, specify and insist on Timken Tapered Roller Bearings. Their exclusive combination of advanced engineering development, precision manufacture and Timken Alloy Steel assures you of the utmost in smooth operation; friction and wear reduction; radial, thrust and combined load capacity; constant alignment of moving parts.

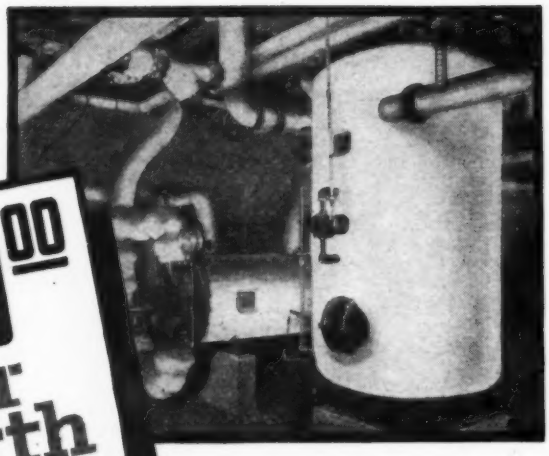
Equipment manufacturers who use Timken Bearings usually indicate this fact in their advertising and on their machines with the "Timken Bearing Equipped" symbol; make it your guide when buying. The Timken Roller Bearing Company, Canton 6, Ohio.

**Look for the trade-mark "TIMKEN" on every bearing you use.**

**TIMKEN**
TRADE-MARK REG. U. S. PAT. OFF.
**TAPERED ROLLER BEARINGS**

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

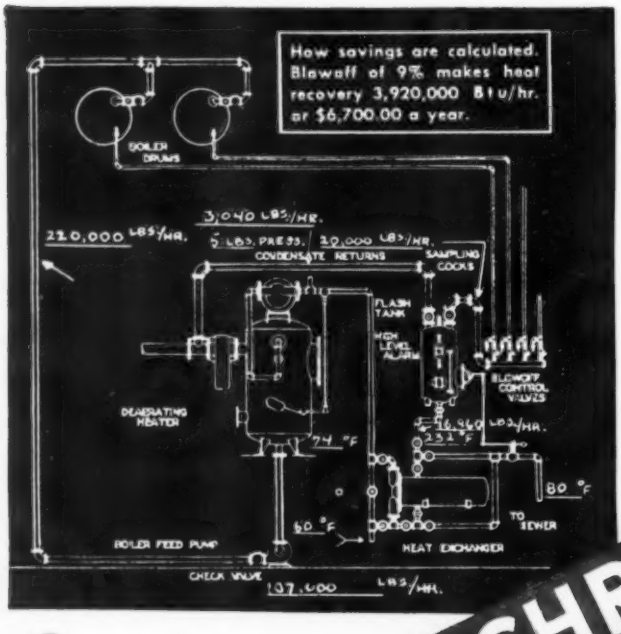
*Flash tank of Cochrane Continuous Blowoff System at Union Station Power Plant, Terminal R. R. Assoc., St. Louis, Mo.*



# $6700.00 a year is worth SAVING!

CONTINUOUS BLOWOFF is such a money-saver, that it is surprising to find numbers of boiler plants that still rely on intermittent blowoff with its wasteful extravagance in steam and man power, to say nothing of unequal boiler concentrations. Examples like that of the Union Station Power Plant of the Terminal Railroad Association of St. Louis, where savings made possible by Cochrane Continuous Blowoff total $6,700.00 *every year,* should be convincing evidence. If *you* are not yet aware of the savings inherent in Continuous Blowoff, write today for a copy of Cochrane Publication No. 4081.

COCHRANE CORPORATION • 3106 N. 17th ST., PHILADELPHIA 32, PA.




If boilers are operated at their full capacity, delivering 200,000 lb. steam per hr. at 150 lb. per sq. in. gage pressure with a blowoff at 9% of the water fed to the boilers, the heat recovery figures out as 3,920,000 Btu per hour. This is equivalent to an annual saving of $6,700.00 when operating at full rating 24 hours per day, 300 days per year.

Continuous BLOW COCHRANE SINCE 1863 OFF System


cal Engineers (4) J R Townsend, materials engineer, Bell Telephone Laboratories, Inc, New York, N. Y., representing American Society for Testing Materials.

**Battelle Institute** appointed Stephen M Davis to its staff. He will be engaged in fuels technology research.

Charles W Shugert, assistant to advertising manager of Shell Oil Co., was elected president of **Industrial Advertising Assn of N. Y., Inc.** Other officers elected at the meeting were: R D Towne of W L Towne Advertising, vice-president; H E Fry of North American Philips Co, second vice-president; and F C Meystre Jr, of De Laval Separator Co, secrerary-treasurer.

## OBITUARIES

**Marion A Savage,** 62, consulting engineer for General Electric Co, who received international recognition for his design of large turbine-generators, died April 9 at his birthplace, Waterboro, S. C.

**E L Berry,** 52, vice-president in charge of production, Link-Belt Co, Chicago, died April 3 as a result of a heart attack.

**Milton Roy Sheen,** 63, president and cofounder of Milton Roy Co, died April 3 at his home in suburban Glenside, Pa.

**David D Sullivan,** 74, chief engineer for Harvard University for 42 years before his retirement in June 1946, died at Boston on April 16.

**Fred J Doherty,** 59, an engineer at New England Baptist Hospital, Boston, died at his home in Roxbury, Mass., on April 16.

**Theodore B Telaak,** 67, assistant chief engineer at Buffalo General Hospital, died recently at his home in Buffalo, N. Y.

**Herbert F Whalen,** group leader of lacquer research at Monsanto Chemical Company's Merrimac div plant, Everett, Mass., died at the plant on April 9.

**Oliver D Dales,** 72, former chief engineer of Buffalo, Niagara & Eastern Power Corp, died on Mar 27 in Clearwater, Fla.

**Robert G Williams,** 62, stationary engineer of Whitesboro, N. Y., died recently in St. Luke's Hospital, Utica, N. Y.

**Henry L Leopold,** stationary engineer for 22 years, at J B Wells & Sons Co. Utica, N. Y., died April 9 after a brief illness at his home.

**William G Hickling,** 50, vice-president and general manager of N. Y. State Electric & Gas Corp, died of a cerebral hemorrhage April 10 at Memorial Hospital in Syracuse. His home was at Binghamton.

**William H Lamb,** superintendent of electrical dept of North Station, Boston, Mass., died at Haverhill, Mass., on April 9. He had been in the employ of Boston & Maine Railroad for 25 years.

# THE BURNER that makes a new Boiler EASIER TO BUY

***Thorough, accurate mixing of fuel and air . . . complete combustion . . . with Coppus-Dennis* FANMIX**

When planning new gas or oil fired boilers, you can count on investing less in boiler, stack and auxiliary equipment — if you select a Coppus-Dennis FANMIX Burner. Coppus equipment was used for instance in 93% of 191 petroleum refinery plants built for war use.

**FANMIX Saves Combustion Space**

FANMIX delivers to the furnace a homogeneous mixture of fuel and air, without blow-torch action. Combustion is rapid and complete — so smaller combustion space is needed than when the furnace must serve as mixing chamber as well — or ratings of present equipment can be increased.

**FANMIX Creates Own Forced Draft**

Less furnace draft is needed than with any other burner, because FANMIX creates its own forced draft, thus overcoming draft loss across the burner (at any operating range). Less stack is needed, and forced draft equipment can be eliminated entirely.

There are two FANMIX types—one to handle natural gas, the other a combination type to burn either gas or oil in entirety or gas and oil in any proportion. (No oil guns needed).

Coppus engineers FANMIX Burners for individual applications. Complete control over rate of combustion or "flame pattern" can be provided to meet the requirements of any installation. Coppus Engineering Corporation, 166 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

*New Bulletin Will Help You When Installing New Equipment or Modernizing Old*

ANOTHER
**COPPUS**
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
166 Park Ave.,
Worcester 2, Mass.

Please send Bulletin 410-4 to

Name.....

Company.....

Address.....

## *Advanced* PEERLESS JET PUMPS

*Economically Produce the Water You Require for Light Industrial Needs*

**CAPACITIES: 120 to 7500 Gals. per Hour. From well depths to 120 Feet.**

The Peerless engineering achievement of designing and building more efficient pumps with fewer moving parts has again been most successfully applied in the advanced Peerless Jet Pumping System. The trouble-free Peerless Jet Pump principle ingeniously applies the natural force of gravity, plus a minimum of mechanical power, to lift water upward by pressure from the Jet and force it to a pressure tank by means of an impeller. There is no simpler pump principle now being utilized where water lift requirements are comparable. Peerless Jet Pumps are easy to understand, install, operate and maintain. Once the constant-pressure Jet Pump is in operation, adjustment or repair is rarely needed. Extremely compact in design. Double or single pipe systems available in sizes from ¼ to 3 H.P. Quietly supplies the water you require whether installed over the well or offset at a distance from the water source. Ideally applied to wells 2" inside diameter and larger for water supply requirements of light industry including ice and refrigeration plants, creameries, dairies, milk plants, institutions, hotel, laundries, municipalities, motel, country estates, schools, etc.

*See The* **PEERLESS Water King**

*Unique in design and operation. For shallow well installation only.*

Fully protected Under R. Moineau U. S. & Canadian patents.

For trouble-free simplicity of operation, this unique pump utilizes the same "magic" pumping element of the Peerless Hi-Lift Pump. Hard chrome pumping element wholly positioned and protected within pump base is highly resistant to abrasive and corrosive action. Assures a clean constant water supply. Requires a minimum of space and attention. 100% automatic. Easily installed over well or off-set.

***Write for Bulletins describing these two most efficient pumps.***

**PEERLESS PUMP DIVISION**

*Food Machinery Corporation*

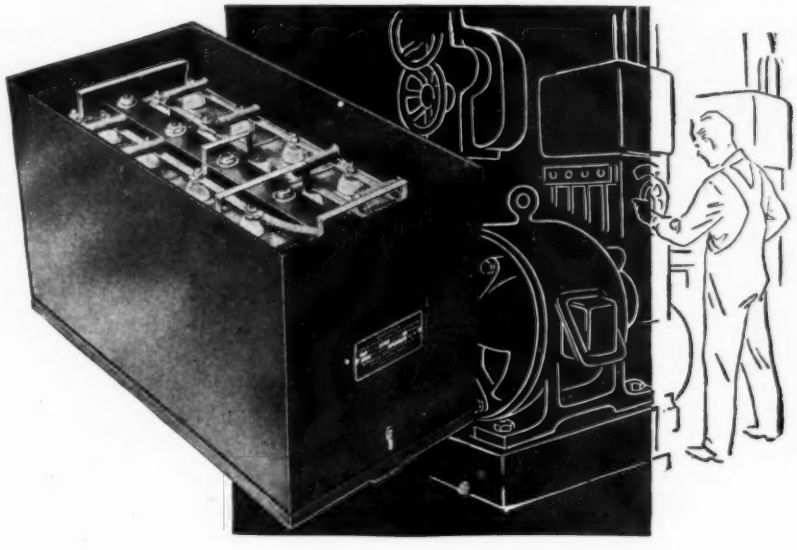
*Factories:* Canton 6, Ohio • Quincy, Ill. • Los Angeles 31, Calif. *District Offices:* Canton 2, Ohio, Philadelphia: Suburban Square, Ardmore, Pa.; Atlanta: Rutland Bldg., Decatur, Ga.; Dallas 1, Texas.

# PROMPT DELIVERIES

# SPRAGUE

## POWER FACTOR CORRECTION CAPACITORS

**(Low Voltage Source-correction Types)**



Sprague Unit-Cell Box Type Capacitors offer a logical, easy-to-install, and distinctly economical means of correcting low power factor for small or large power consumers. Installation on the low-voltage side as close as possible to the equipment being served means that the entire circuit is corrected. Moreover, this method often avoids installing larger conductors, switch gear and other equipment in plant circuits—or permits operation of a greater useful load from present circuits.

Sprague PFC Capacitors are available in sizes of 1, 2, 3, 4, 5, 6, 8, 10 and 15 KVA. Any required capacity may be obtained by combining these standard values. *Prompt deliveries can now be made on all sizes.*

***For small or large power users!***

**WRITE FOR CATALOG**

Sprague Catalog 50 contains helpful power factor correction data, installation suggestions and descriptions of Sprague Unit-Cell Capacitors. A copy will be sent promptly on request.

**SPRAGUE ELECTRIC COMPANY, North Adams, Mass.**

# DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

## This Economizer was Chemically Cleaned!

***FULL EFFICIENCY RESTORED***

***SAFELY, RAPIDLY, THOROUGHLY!***

To keep this economizer living up to its name, it has been *chemically* cleaned many times. Every one of its tubes and 440 return bends has been cleaned in place—without dismantling. The cleaning operation usually takes less than 12 hours—with resultant higher efficiency and the avoidance of frequent cleaning of the boiler.

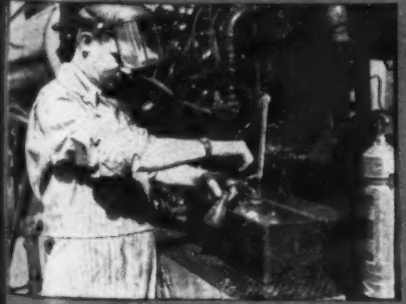
Economizers may be cleaned separately—or along with the boiler. Dowell engineers fill the equipment with selected liquid solvents designed to dissolve and disintegrate power-stealing scale and sludge. They use special truck-mounted tanks, pumps, mixers, heaters and control equipment.

To save dismantling and down time—to reduce operating costs—to maintain efficiency in heat exchange equipment, boilers, condensers, water lines and water wells—call the nearest Dowell office.

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

New York, Boston, Philadelphia, Wilmington, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.

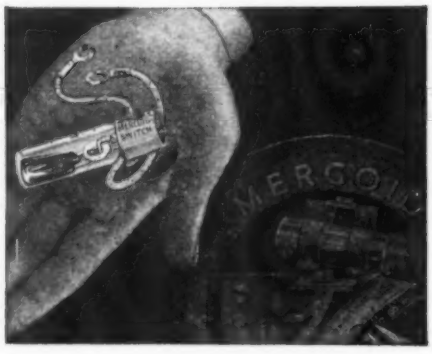
Long Beach, Casper: Dowell Associate—International Cementers, Inc.



**Dowell service is supervised by trained engineers using carefully selected liquid solvents and special mobile equipment.**

**DOWELL**

FOR INDUSTRIAL CHEMICAL SERVICE



# A MERCOID
## UNFAILING ADVANTAGE

Whatever your control requirements may be, it is conceded that the switch in a control warrants first consideration, due to its functional characteristics. All Mercoid Controls are equipped exclusively with hermetically sealed mercury switches of special design and selected materials.

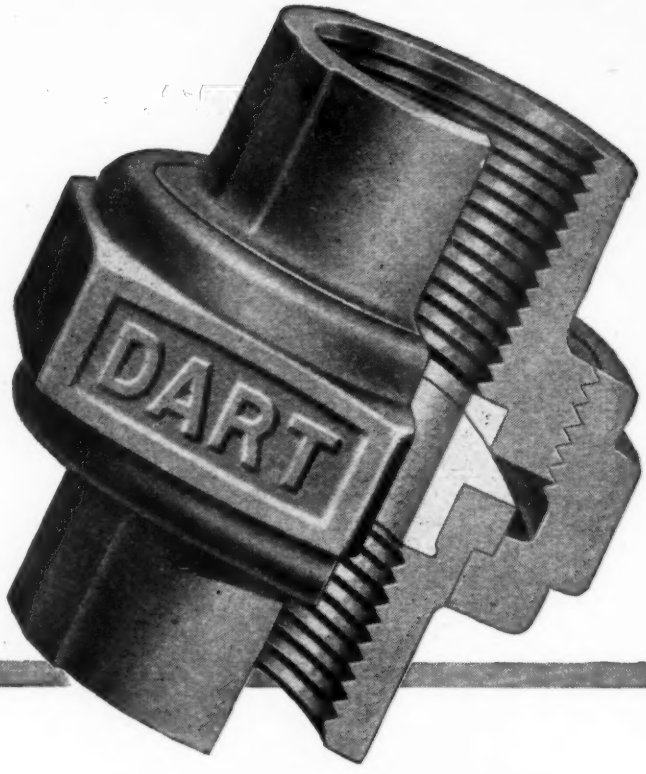
Mercoid mercury switches are known the world over for their dependable service. They are not affected by dust, dirt or corrosion; nor are they subject to open arcing with its attendant consequences of pitting, sticking or oxidized contact surfaces, all of which, are likely to interfere with normal switch operation.

That is why among other things, Mercoid Controls on the whole give you assurance of better control performance and longer control life—a distinct and unfailing advantage—the reason why they are also the choice of America's leading engineers for many important industrial applications.

*MERCOID CONTROLS are available in a variety of types for sensitive control of Pressure, Temperature and Lever actuation.*

MERCOID
APPROVED CONTROLS

THE MERCOID CORPORATION
4201 BELMONT AVENUE • CHICAGO, ILLINOIS




# DART
## *The Union for Leak-Proof Protection*

**THE TWO BRONZE SEATS ARE GROUND TO FORM A TRUE BALL JOINT**

Dart Unions insure leak-proof protection because their two bronze seats are *precision-ground*. This means that they fit tighter and close easily, without excessive wrenching, to a drop-tight connection. Despite length of service, they uncouple easily for use elsewhere — and they cost least in the long run. Body and nut, made of high-test, air-refined malleable iron, are practically indestructible.

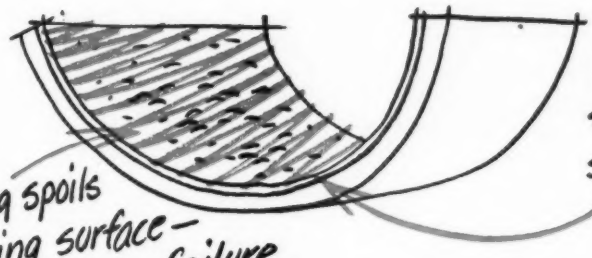
Ask your supplier to demonstrate the many features of Dart Unions.

DART
UNIONS

E. M. DART MFG. CO., PROVIDENCE 5, RHODE ISLAND

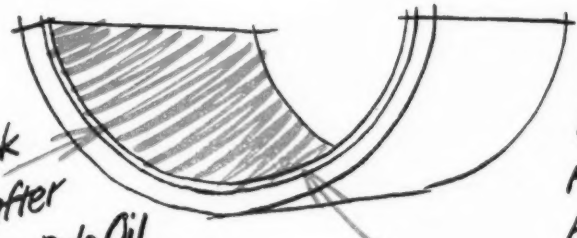
# LUBE MEMO

## Why it's smart to avoid "metal eating" lube oils



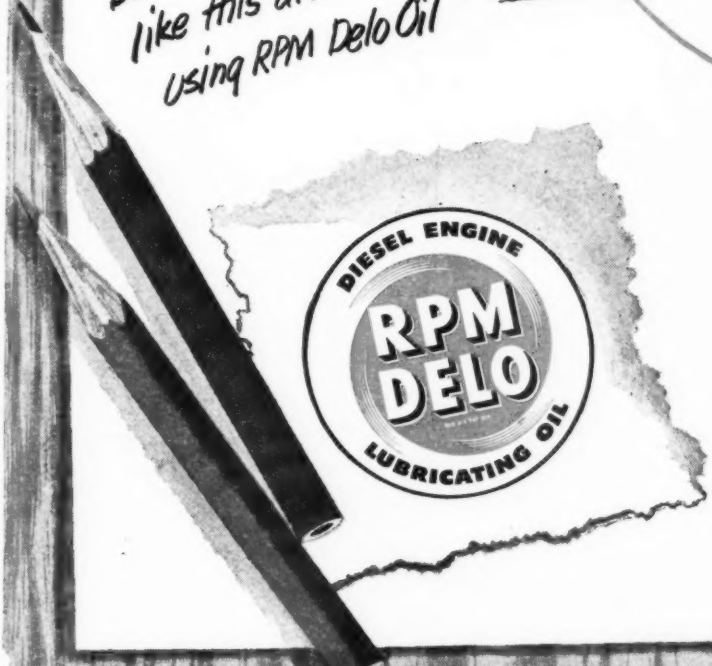
Heat and air in Diesels make many oils corrosive so they "eat" lead from structure of alloy bearings

pitting spoils bearing surface — leads to failure



Joe says bearings look like this after using RPM Delo Oil

1. RPM Delo Diesel Engine Lubricating Oil contains anti-oxidant compound, resists effects of heat and air.
2. Gives bearings direct protection against corrosion.




Note — arrange trial of RPM Delo Oil ... looks like it'll save us $$!

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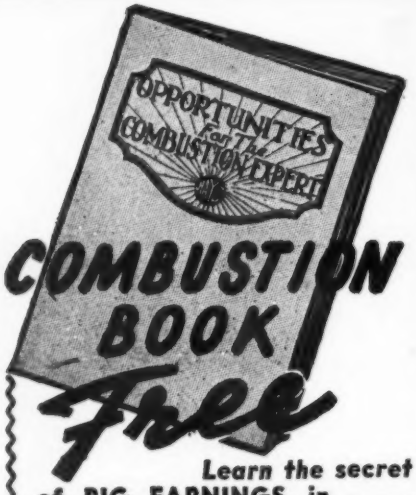
THE CALIFORNIA COMPANY • Denver, Colo.
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA OIL COMPANY • New York

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*Learn the secret*
of BIG EARNINGS in . . .
COMBUSTION ENGINEERING

There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

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PILLOW BLOCKS

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They, are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

***Write for Bulletin.***

**"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors**

*Over 44 Years in Business*

**STANDARD PRESSED STEEL CO.**
**JENKINTOWN, PENNA., BOX 577**
**Boston • Chicago • Detroit • Indianapolis**
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See how RANAREX* cuts up-the-stack heat loss

You can save as much as 20% on up-the-stack heat loss with Ranarex. This instrument measures flue $CO_2$ accurately, showing *instantly* when furnace needs regulating.

Ranarex contains no chemicals or delicate parts, yet it's accurate to within 3/10 of 1%. Install this valuable fuel-saver before more heat goes up the stack!

**FREE BOOKLET**

. . . on request. Write to The Permutit Company, Dept. PR6, 330 West 42nd St., New York 18, N. Y.

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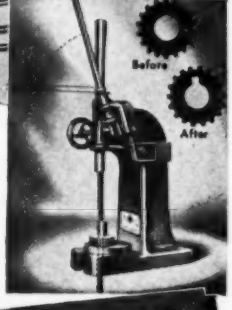
**RANAREX**
**PRODUCT OF PERMUTIT**

***Ever Wish You Could Cut Your Own Keyways, Quick and Cheap?***




**This New *Minute Man* Keyway Broach Kit Does the Job, By Hand, In One *Minute***

Cuts keyways any standard width, any depth, in pulley hubs, collars, couplings, gears, cutters or what not. Kit shown cuts 15 sizes, pays for itself in no time even if your uses for keyways are few and far between.

Write for Catalog "P" containing the whole story and prices on broaches, complete kits including keyway stock and du Mont Arbor Presses (handy to have around any shop) as well as valuable reference data.

The du MONT CORPORATION
GREENFIELD, MASSACHUSETTS

# • DIRECTORY of UNION • BOILERS

UNION IRON WORKS • ERIE, PENNSYLVANIA



**H-TYPE,** a self-contained steel cased generator unit for any fuel or firing method, for any desired capacity or pressure.



**N-TYPE,** 4-drum steam generator doubles the radiant surface of other designs without the use of water walls and auxiliary headers.



**B-TYPE,** 4-drum design. Gas, Oil or low fusion Western coal can be readily burned in this furnace which is water cooled and provided with cast iron armor protection.

**A-TYPE,** 3-drum design with special front bank tube curvatures to increase the radiant surface, accelerating speed of circulating and rate of steaming.



**O-TYPE,** fully water cooled furnace with all water wall supply tubes inside the setting. A minimum of unprotected brick-work is exposed in the furnace.



**L-TYPE,** for low headroom conditions, two top drums at the same level providing maximum steam disengaging surface. Many sizes can be shipped shop assembled.



**S-TYPE,** provides water walled furnace that does not require circulator connections, the setting except for front and bridge walls is constructed of refractory tile water cooled, insulated steel panel cased.



**LD-TYPE,** long drum with box header construction with either single or double horizontal drums. A thoroughly standardized unit built in units as large as 7,000 square ft. of heating surface.

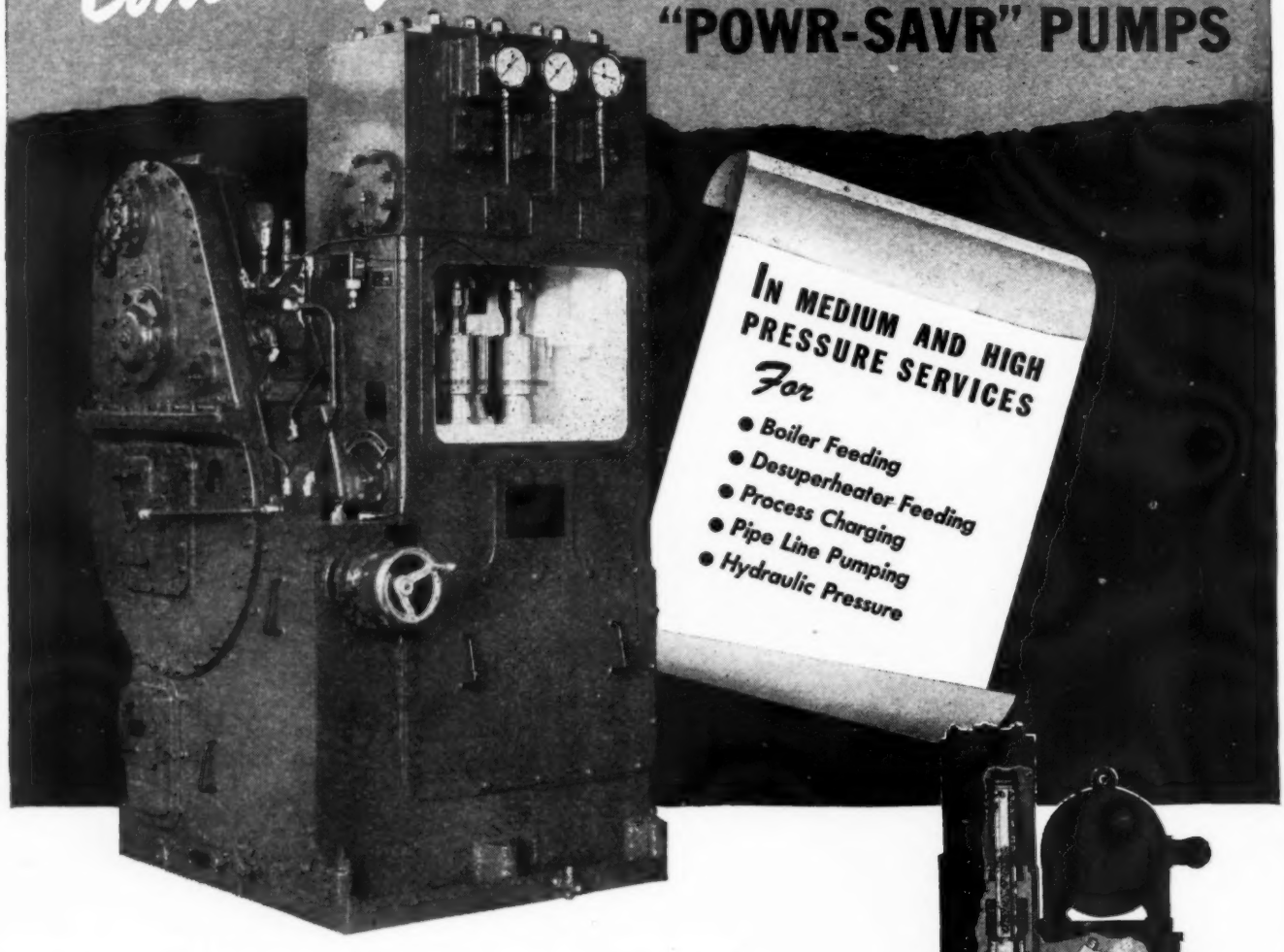
**XD-TYPE,** cross drum box header type, with steep inclination to the main tube bank to promote rapid circulation — Smaller sizes can be shipped fully assembled or tube bank assembled and drum detached.

**UNIVERSAL,** fire tube boilers sizes to 300 H. P. (1) for brick setting — (2) steel cased refractory lined in self-contained units — (3) either of these styles with water cooled furnaces.

**LITTLE GIANT,** a shop assembled unit combining pressure element and steel refractory lined furnace — one piece boiler shell — 9 sizes 10 to 75 H.P. for 100 or 150 lb. W. S. P.

**KD-TYPE,** a knocked-down cross drum type boiler adapted from the Union Cross Drum Power Boiler design. No field welding required. 14 sizes from 2996 thru 34,119 sq. ft. E. D. R. S. H. B. I. steam rating.

# Control of Delivery IS A SIMPLE MATTER . . . with ALDRICH-GROFF "POWR-SAVR" PUMPS




**Unique in their efficient use of power for variable delivery requirements, Aldrich-Groff pumps operate at constant speed and their power consumption is practically proportional to delivery. Users report substantial power savings as well as low maintenance expense.**

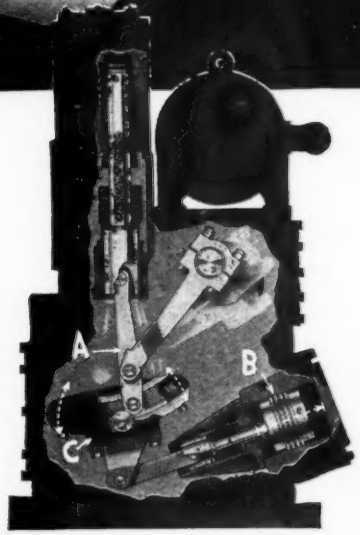
**Discharge is varied manually or automatically, either at the pump or from a remote station. The variation is stepless from zero to full capacity.**

**Aldrich-Groff pumps are available in six standard sizes, ranging up to 100 bhp and to 15000 psi. Their use is increasing wherever power savings, extreme mechanical reliability and simple, accurate control of delivery is important. Over 300 units in successful operation for periods ranging up to 6 years.**

**For full particulars, write today for Data Sheet 65.**

**The Aldrich Pump Co., 3 Gordon Street, Allentown, Pa.**

*Representatives: Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland Denver • Detroit • Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha Pittsburgh • Philadelphia • Portland, Ore. • Richmond, Va. • St. Louis • San Francisco Spokane Wash. • Syracuse • Tulsa*

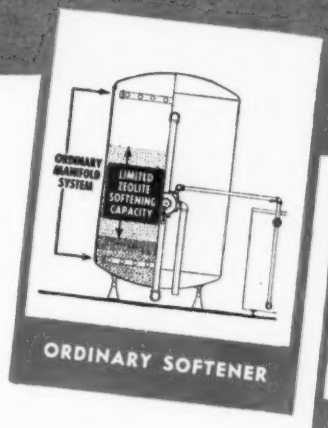



**Power is supplied to plunger by connecting rod through a link (A). Length of plunger stroke is controlled by piston (B) which positions stroke transformer (C). In zero stroke position, the link has a pendular motion and the plunger is stationary. To increase delivery, the stroke transformer (C) is tilted, so that the link motion is given a vertical component which actuates plunger through any travel up to full stroke.**

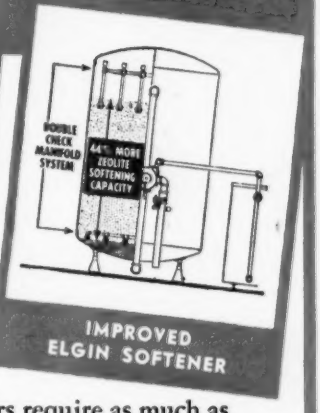
ALDRICH . . . anticipates industry's pumping needs

# SEE FOR YOURSELF!

## ...how Elgin has revolutionized water softening




ORDINARY SOFTENER




IMPROVED ELGIN SOFTENER

Prior to introduction of the improved Elgin, all zeolite water softeners were built basically like the ordinary unit here diagrammed. Note how the zeolite bed — the part that actually does the water softening — is comparatively shallow. This, in reality, was a compromise adopted as an attempt to limit the escape of zeolite during backwashing.

But now see how the present-day Elgin has changed the picture. By perfecting a new manifold system that prevents the escape of zeolite mechanically, Elgin has made it possible to utilize a far deeper zeolite bed. Coupled with the more efficient water distribution and zeolite regeneration made possible by this "Double-Check" Manifold, this deeper zeolite bed produces up to 44% more soft water output than can be delivered by an ordinary water softener of equal size. And this "Double-Check" principle is an Elgin development, fully protected by patents.

Obviously, in terms of soft water delivered, the Elgin way can reduce your original investment. It provides a more compact installation, too, since ordinary softeners require as much as 50% more space. And it keeps on saving over the years. The more thorough backwashing of the "Double-Check" system produces more zero-soft water per pound of salt, and keeps zeolite clean and active during a longer life. Prevention of zeolite loss means further economy.

## Modernize old softeners, too

Your old softener, no matter what make, can be stepped up this new Elgin way. The "Double-Check" Manifold plus Elgin High Capacity Zeolite can mean as much as 44% more soft water output, at surprisingly low cost.

THE IMPROVED ELGIN GIVES 44% MORE SOFT WATER

The whole story is told in a new Bulletin that you will want to read. Ask for Bulletin 607. For hospitals, request Bulletin 608. For laundries request Bulletin 609.

Not all Elgin developments are outwardly as sensational as that described above, but the Elgin solution to *any* water conditioning need is equally direct and effective. It may be along mechanical lines. It may be along chemical lines. *But* in any case it will be along the straight line to low cost, trouble-free water conditioning. There is an Elgin engineer nearby who would like the opportunity to prove this.

**ELGIN SOFTENER CORPORATION**

130 N. GROVE AVENUE, ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

# 7 USES FOR LUMNITE IN POWER PLANTS

1. **Ash Pit and Cinder-Catching Linings**—Heat-Resistant LUMNITE concrete withstands wear and corrosion in both wet-type and dry-type units.
2. **Coal Bunker Linings**—LUMNITE concrete resists abrasion and corrosion.
3. **Flue and Duct Linings**—LUMNITE concrete resists abrasion of flue gases and fly ash. Provides insulation where required.
4. **For Steel Stacks**—Jointless LUMNITE linings protect steel stacks from corrosion. Their insulating properties improve efficiency.
5. **For Brick Chimneys and Linings**—LUMNITE mortar resists attack of sulphurous gases and corrosive condensate formed in intermittent and low-temperature operation.
6. **Castable Refractories, made with** LUMNITE—used for jointless walls and arches, baffles, burner blocks, door linings, stoker settings and general refractory purposes.
7. **Overnight Structural Concrete**—For rapid maintenance, LUMNITE provides full-strength concrete in 24 hours or less, even in freezing weather.

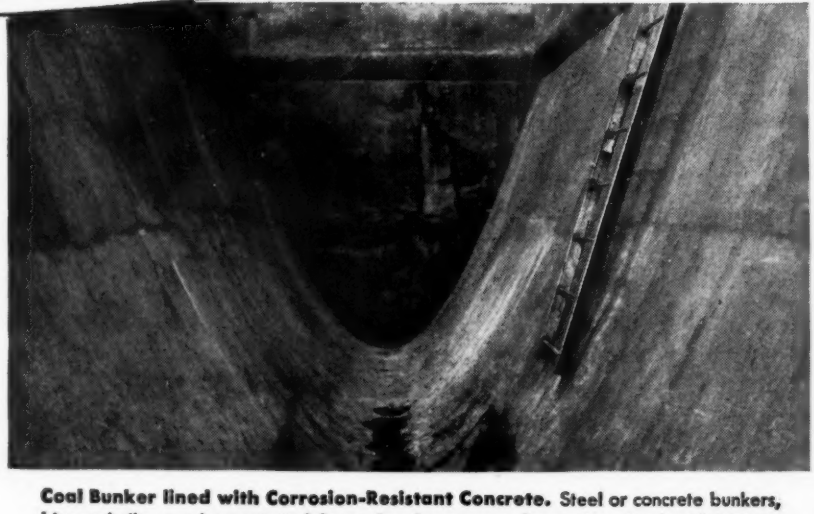
## WAYS TO REDUCE OUTAGES AND CUT MAINTENANCE COSTS

*Ready-to-Use*
**CASTABLE REFRACTORIES**

Castable Refractories are factory-prepared mixtures of LUMNITE and selected aggregates. They are mixed with water on the job and cast into place for door linings, arches, baffles or furnace walls. Special shapes can be cast in molds, ready for use within 24 hours.

Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

*Specify Castables*
**MADE WITH LUMNITE**



**Coal Bunker lined with Corrosion-Resistant Concrete.** Steel or concrete bunkers, bins and silos can be protected from abrasive wear and corrosive attack with LUMNITE linings—cast-in-place, plastered or applied with a cement gun.

*Write today for information on the many uses of LUMNITE in power plants.*

**Lumnite Division**
**UNIVERSAL ATLAS CEMENT COMPANY**
UNITED STATES STEEL CORPORATION SUBSIDIARY
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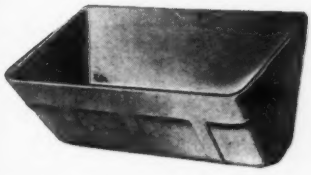
"THE THEATRE GUILD ON THE AIR"—*Sponsored by U.S. Steel—Sunday Evenings—ABC Network*

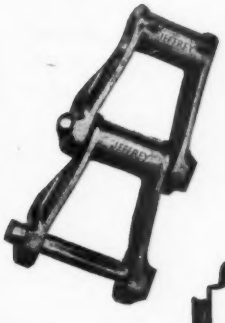
# Index of Quality

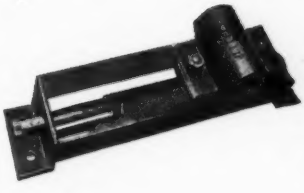
GENUINE



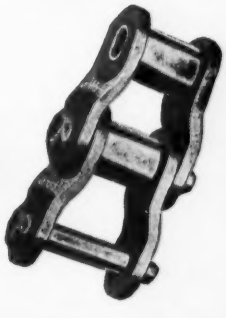
JEFFREY

REPLACEMENT





PARTS



**Most standard Jeffrey parts are available when replacement becomes necessary. What's more, they are exact duplicates of original equipment except where Jeffrey improvements from time to time have made them even better. To prevent costly shut-downs and insure longer wear, insist on Jeffrey Replacement Parts.**

THE JEFFREY MANUFACTURING COMPANY

932-99 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

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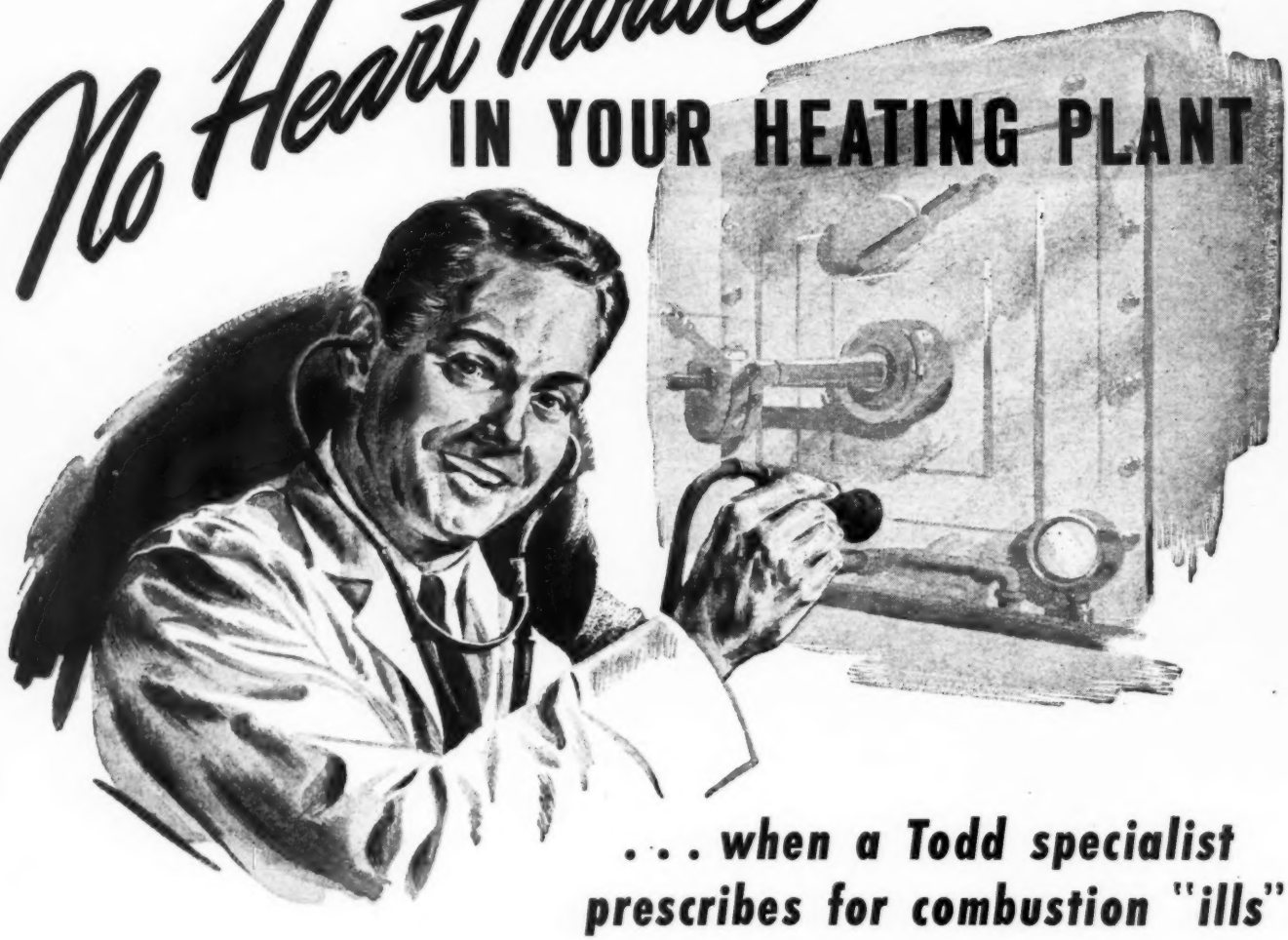
# No Heart Trouble IN YOUR HEATING PLANT



## . . . when a Todd specialist prescribes for combustion "ills"

Right at the *heart* of your heat and power system — the combustion equipment — there can be operating waste that will make your cost sheets *look sick.*

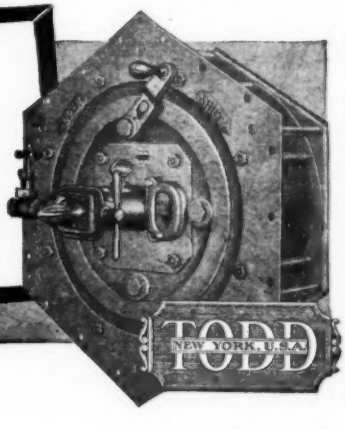
Replacement of obsolete installations with modern Todd Oil Burners can cut your fuel consumption as much as 10%, *or more*—and, at the same time, step up your power and heat capacity.

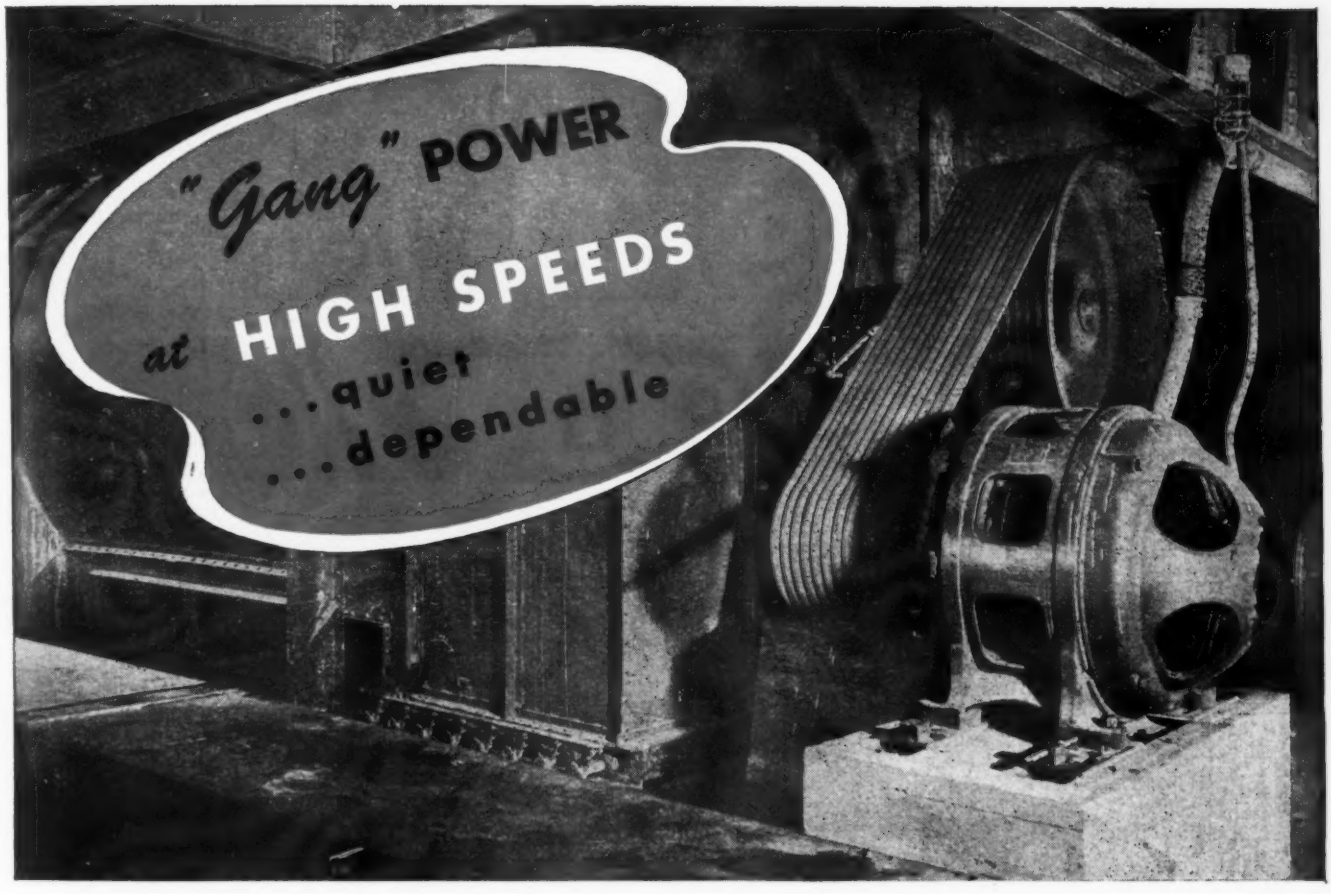
Todd engineers can show you case record after case record like this, as well as many "plant histories" where the initial cost of modernizing with Todd Burners was wiped out in three years by savings in fuel and maintenance charges.

Many standard and modified types of Todd Burners are available and each job is individually engineered to provide the right application for the heat and power needs of any industrial or commercial installation. Consult Todd engineers on *your* combustion problems!

**COMBUSTION EQUIPMENT DIVISION**
**TODD SHIPYARDS CORPORATION**
81-16 45th Avenue, Elmhurst, Queens, N. Y.

NEW YORK, BROOKLYN, ROCHESTER, HOBOKEN, NEWARK, PHILADELPHIA, CHICAGO, CHARLESTON, S. C., BOSTON, SPRINGFIELD, MASS., BALTIMORE, WASHINGTON, DETROIT, GRAND RAPIDS, TAMPA, GALVESTON, MOBILE, NEW ORLEANS, LOS ANGELES, SAN FRANCISCO, SEATTLE, MONTREAL, TORONTO, BARRANQUILLA, BUENOS AIRES, LONDON






# Condor WHIPCORD V-BELTS

Where high speed and constant operation of machinery are vital to a process, you can't beat Condor Whipcord V-Belts.

In malt production, for example, huge blowers must move air at rates up to 200,000 cubic feet per minute —first, cool humidified air during the germinating process—then hot, dry air to dry the malt after germination.

It is on machinery like this that Condor Whipcord V-Belts deliver their best. Despite the terrific test of short center drives at high speeds, Manhattan's *Flexlastics* dissipate heat and permit the Whipcord Strength Members to give longer service.

Also, the *Flexlastic* cushion in a Condor V-Belt seats it firmly in the sheaves to deliver every possible unit of power to the driven shaft.

Whether your drive is two belts or twenty, make sure you get all "pull" for your power costs by using CONDORS.

(Bulletin No. 6868 B describes 8 acknowledged advantages.)

***"Flexlastics" is exclusive with Manhattan***

RAYBESTOS R M MANHATTAN

## RAYBESTOS-MANHATTAN INC.

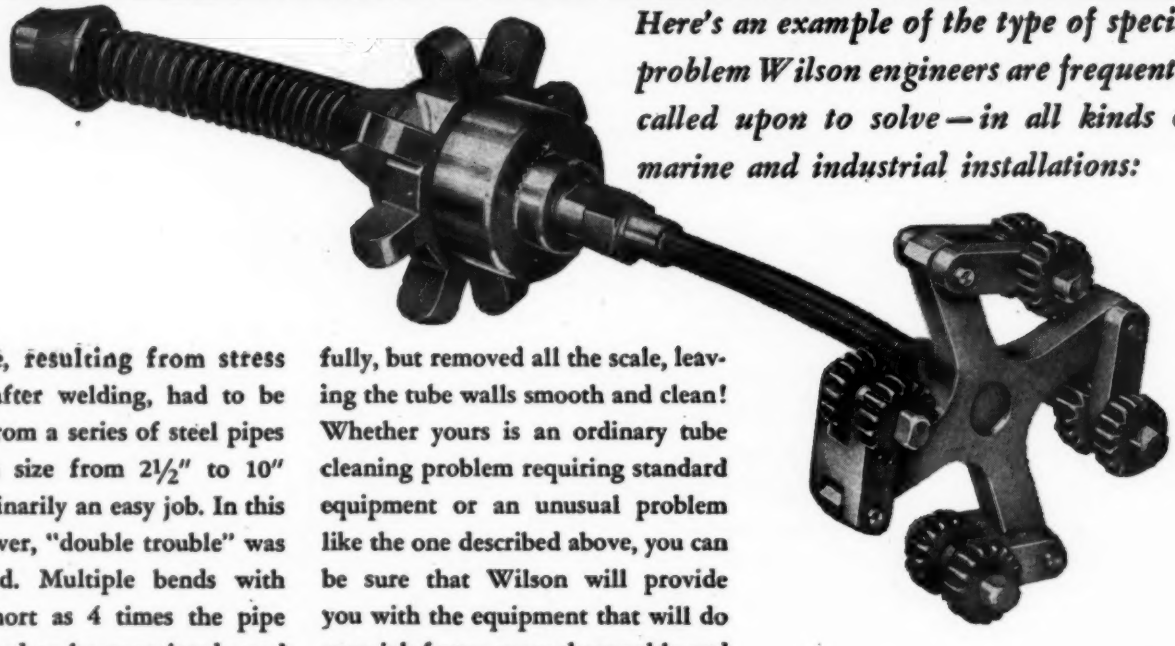
*Keep Ahead with Manhattan*

**MANHATTAN RUBBER DIVISION** **PASSAIC, NEW JERSEY**

# DOUBLE TROUBLE

## in this piping installation

## CLEARED UP WITH A WILSON CLEANER



*Here's an example of the type of special problem Wilson engineers are frequently called upon to solve—in all kinds of marine and industrial installations:*

Mill scale, resulting from stress relieving after welding, had to be removed from a series of steel pipes varying in size from 2½" to 10" O.D.—ordinarily an easy job. In this case, however, "double trouble" was encountered. Multiple bends with radii as short as 4 times the pipe diameter had to be negotiated—and all possibility of marring the interior tube surface had to be eliminated. Specially engineered Wilson Tube Cleaning Equipment made quick work of this problem. It not only negotiated the short bends successfully, but removed all the scale, leaving the tube walls smooth and clean! Whether yours is an ordinary tube cleaning problem requiring standard equipment or an unusual problem like the one described above, you can be sure that Wilson will provide you with the equipment that will do *your* job faster, more thoroughly and more economically. Why not send for the name of your local Wilson representative? He is always ready to help you find the way to greater operating economy through more efficient tube cleaning.

THOMAS C. WILSON, INC. • 21-11 44th Ave., Long Island City 1, N. Y.

# WILSON

## TUBE CLEANERS

TW—726

# Ethylene—

## FOR EXAMPLE

Fractionation unit of an ethylene plant, one of many such plants designed and constructed by Stone & Webster Engineering Corporation.

**Over a half century of broad experience qualifies our organization to assume full responsibility for all phases of design, engineering and construction of projects in the petroleum and chemical industries.**

## STONE & WEBSTER ENGINEERING CORPORATION

**A SUBSIDIARY OF STONE & WEBSTER, INC.**

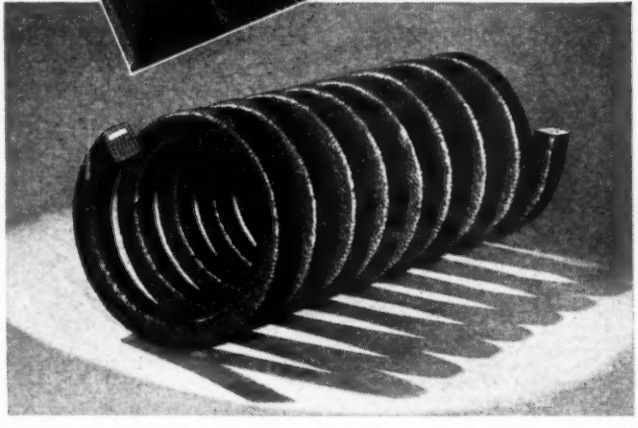
Producing single yarn from asbestos rove on ring spinning frames at the Garlock factory.

# *From A to Z*

Here's another example of Garlock *quality control* from raw material to finished product. Asbestos cloth used in many Garlock products is manufactured in the Garlock textile mill. Included in these products is GARLOCK 150 High Pressure Steam packing which is made of asbestos cloth and rubber.

GARLOCK 150, illustrated below, gives superior performance on steam engines, pumps, compressors, expansion joints, etc., against steam pressures up to 300 pounds. For coil form, specify GARLOCK 125; and for rings GARLOCK 200. Sizes from ⅛ inch to 1½ inch, advancing by sixteenths.

Weaving asbestos cloth at the Garlock factory.



THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.

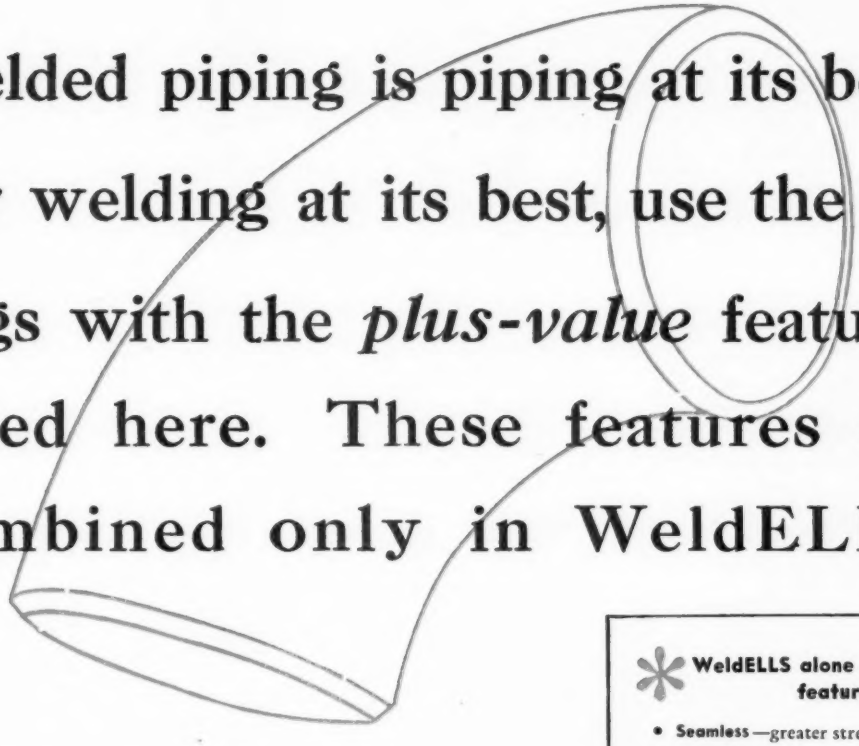
In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

*60th Anniversary 1887—1947*

## GARLOCK *150* HIGH PRESSURE STEAM PACKING

# WeldELLS *have everything**

Welded piping is piping at its best. For welding at its best, use the fittings with the *plus-value* features listed here. These features are combined only in WeldELLS.



**TAYLOR FORGE & PIPE WORKS**

**General Offices & Works: P.O. Box 485, Chicago**

**New York Office: 50 Church Street**

**Philadelphia Office: Broad Street Station Bldg.**

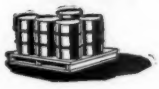
**Los Angeles Office: Subway Terminal Bldg.**

* **WeldELLS alone combine these features:**

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification markings**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

*First,* **INDUSTRIAL TRUCKS . . .**

*Then,* **PALLETIZED UNIT LOADS . . .**



*Now,* **STANDARDIZED**

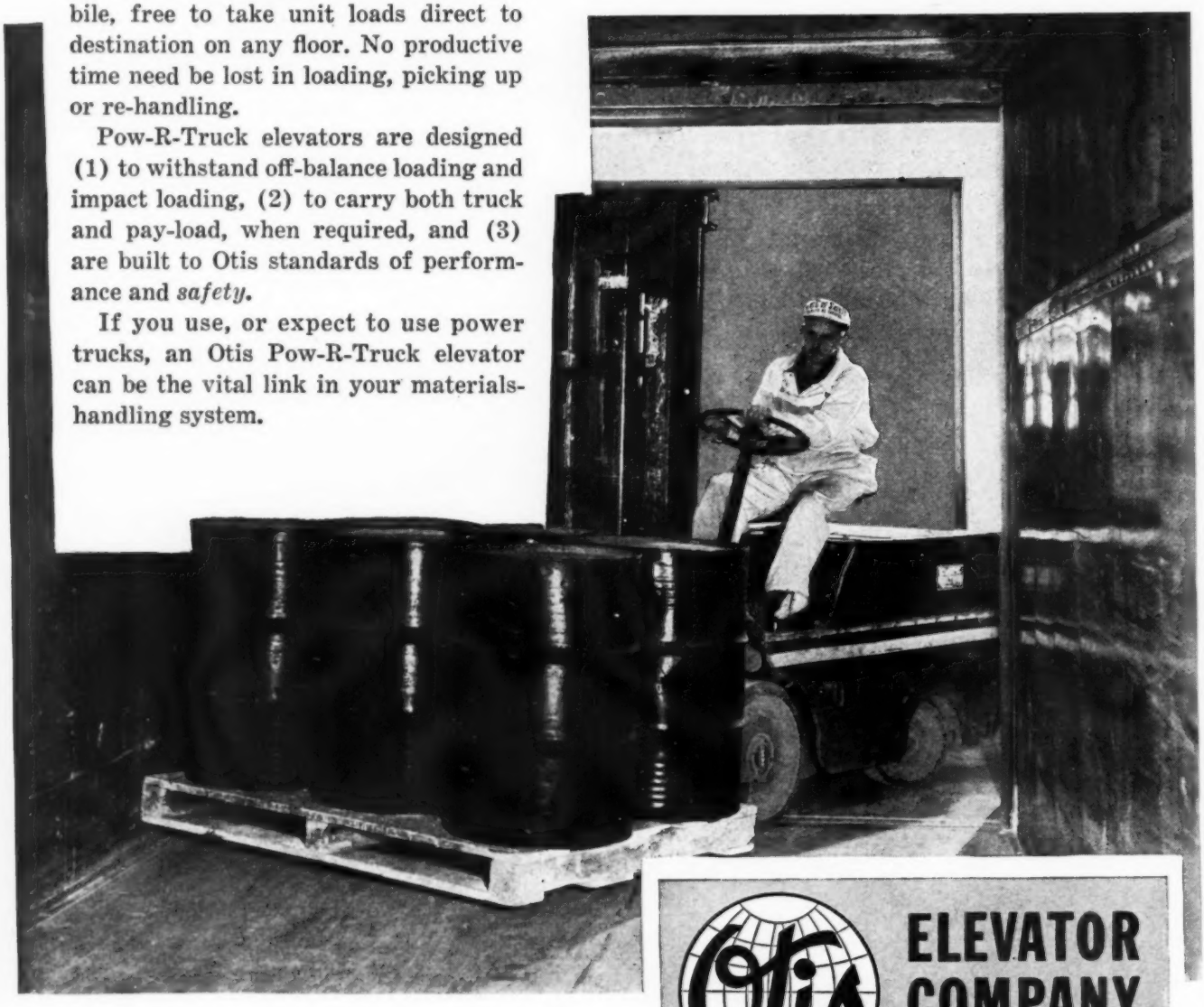
# POW-R-TRUCK ELEVATORS!

This latest addition to the Otis line of standardized freight elevators—previously available only as a custom-built "special"—adds *floor-to-floor travel* to the many other time- and labor-saving advantages of industrial trucks . . . effectively increasing their usability.

With a Pow-R-Truck elevator an industrial truck becomes *completely* mobile, free to take unit loads direct to destination on any floor. No productive time need be lost in loading, picking up or re-handling.

Pow-R-Truck elevators are designed (1) to withstand off-balance loading and impact loading, (2) to carry both truck and pay-load, when required, and (3) are built to Otis standards of performance and *safety.*

If you use, or expect to use power trucks, an Otis Pow-R-Truck elevator can be the vital link in your materials-handling system.



***For illustrated folder please address Otis Elevator Company, 260 Eleventh Ave., New York 1, N. Y.***

**Otis ELEVATOR COMPANY**
**OFFICES IN ALL PRINCIPAL CITIES**

# ...AND LIKE IT!

"Practice what you preach" is an adage that has proved its worth at Pennsalt . . . especially at our Michigan works.

**DOWNTIME SLASHED FROM 10 DAYS TO 10 HOURS!**

At this plant, boiler descaling was previously done by mechanical turbining, involving shutdowns of ten days or more while the unit was being dismantled. A new method—built around our own Pennsalt PM-90 Descaling Compound—completed the entire job in *less than ten hours!* Descaling was more thorough than ever . . . in fact, Pennsalt PM-90 cleaned out pockets probably never cleaned before!

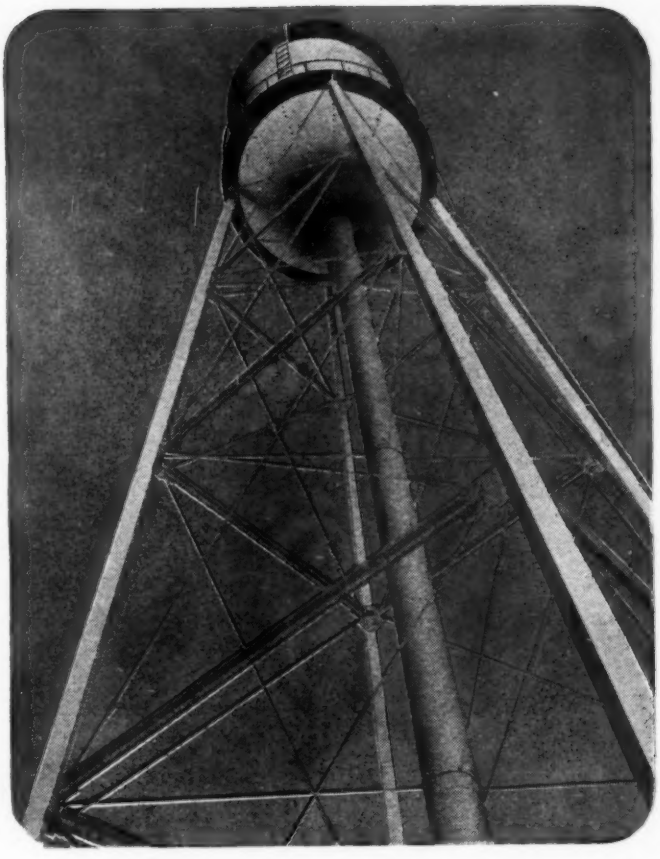
**SEND FOR DETAILED REPORT ON THIS CASE!**

If you are interested in technical facts on this case, write to address below for Case Report No. 69-6, which contains complete details. And if you have a problem in metal cleaning, plating, enamelling or corrosion-proof construction, call in one of our representatives and let him add our experience to your own.

**PENN SALT**
**CHEMICALS**
**97 Years of Service to Industry**

**PENNSYLVANIA SALT MANUFACTURING COMPANY**
SPECIAL CHEMICALS DIVISION, 1000 WIDENER BUILDING, PHILADELPHIA 7, PA.
NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • WYANDOTTE • TACOMA

# How would YOU keep these outdoor cold water lines from freezing?



**Here's the problem:** A manufacturing plant in Ohio is erecting a large outdoor water tower with a 4″ fill line and 8″ standpipe. Water comes from the city system. It is used for processing, fire protection, and sanitation. The plant operates in the daytime only. At night, there is normally no circulation of water. What protection against freezing will prove most satisfactory?

1. **Insulation of lines?**
2. **Forced circulation of water?**
3. **Provision of steam tracer line?**

## HERE'S WHAT THE ARMSTRONG ENGINEER ADVISED:

Before making any suggestions, the engineer found that the city water is delivered at 42° F. in winter. He learned that the lowest temperature ever recorded locally was —18° F., that continuous sub-zero weather has lasted as long as two weeks, and that local winds seldom exceed 15 m.p.h. On the basis of these data, he advised the use of all three methods.

For, no amount of insulation will keep water from freezing if the temperature drops far enough, for a long enough time. Insulation is valuable in order to give the plant engineer a margin of safety. When a mild cold snap occurs, insulation of his cold water lines will give him time to open valves and assure circulation of the water. In a severe cold wave, insulation plus circulation will give him time to get steam into the tracer line.

Sufficient insulation for the above purposes can be furnished at relatively low cost by three 1-inch layers of hair felt, applied over a layer of asbestos paper to the water and steam tracer lines as a unit, and weather-proofed. If a 4″ line holds motionless water at 42° F. in a 15 m.p.h. wind and the temperature outside drops to 18° below zero, this insulation will prevent freezing for about 6 hours.

Armstrong's Cork Covering, usually recommended for insulation of outdoor cold water lines, is not specified in this application because of the steam tracer line.

You are invited to consult Armstrong's engineers on your insulation problems. Whether it's to protect your property in emergencies like extreme cold or to conserve fuel or refrigeration, you'll find these men tackle your problems with both technical know-how and common sense. Over the years, the Armstrong organization has built up a wealth of practical experience, all of which is at your service. Armstrong can help you not only in planning your insulation job but also in providing proper materials and skilled workmanship for the installation.

**Free! New Insulation Chart**

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Company, Industrial Insulation Dept., 7006 Maple Avenue, Lancaster, Pa.

**ARMSTRONG'S INDUSTRIAL INSULATION**

*Complete Contract Service For All Temperatures*

From 300° Below Zero

To 2600° Fahrenheit

# Boilers by edge moor

## Vertical Flow Bent Tube Boiler

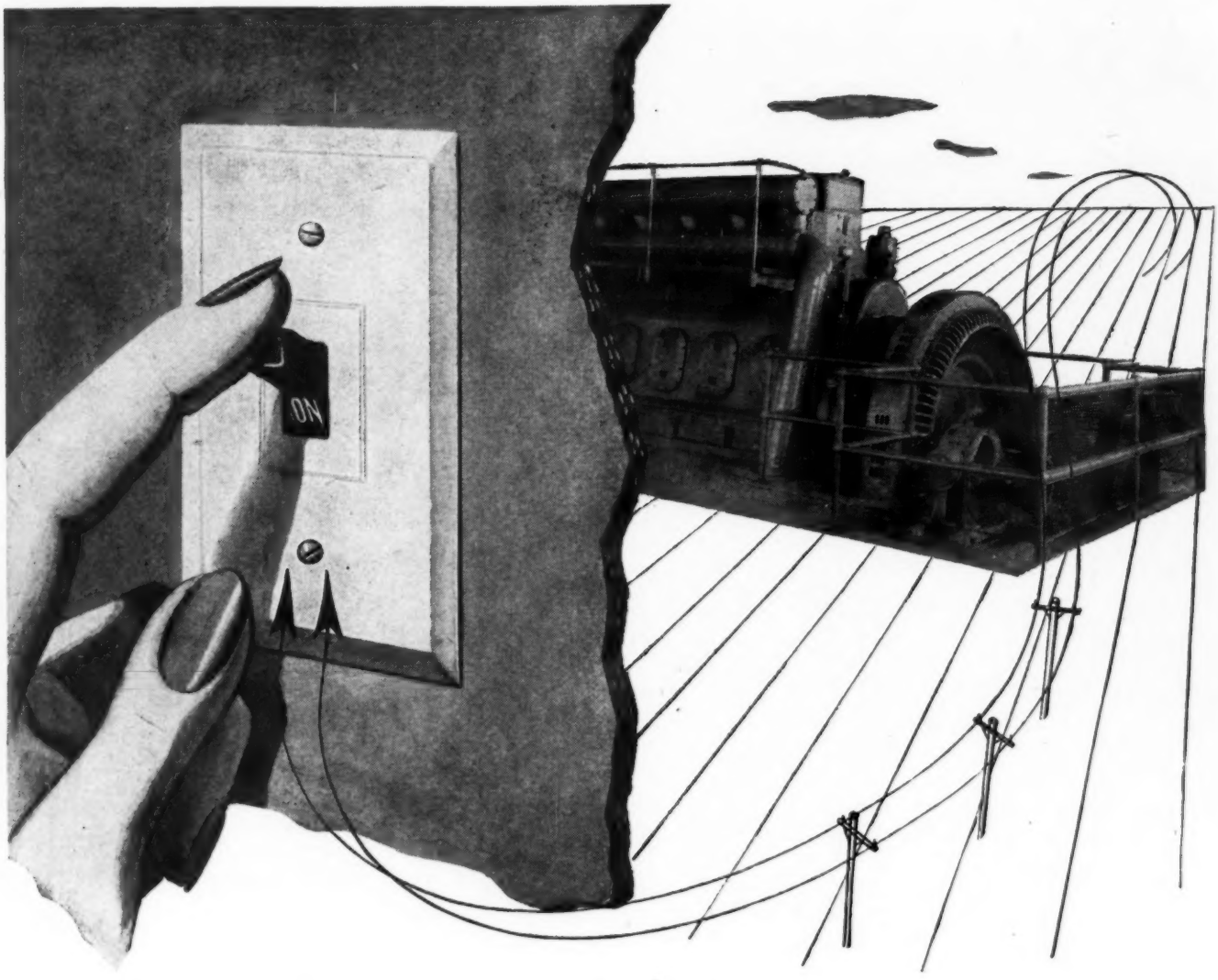
This unit is designed for maximum output in a limited space. It is a combination of a simple two-drum boiler bank, having perfect U-tube circulation, and a water-cooled furnace, integral with the boiler. The large amount of surface exposed to radiant heat results in a quick-steaming unit that will give rapid response to load changes. This unit is adaptable to all fuels and is available in all sizes.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today.

EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

**edge moor** steam generating equipment

EM




# There's a *BALDWIN DIESEL* behind it!

Plants all over the country are making enviable records for dependable service and economical operation . . . with the help of Baldwin diesel engines. These engines are designed and built to do *more* for *less*.

You'll find the key to the excellent performance of Baldwin diesels in precision workmanship. Crank shafts, cam shafts, pins, liners and similar parts are ground or honed to hair-splitting tolerances. Jigs and fixtures are extensively used, to assure exactness in machining operations. Multiple spindle boring machines help to give accuracy in drilling. Built like a watch, the Baldwin diesel engine runs like a watch.

If you are aiming for top performance in your new equipment, put a Baldwin on the job.

The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Boston, Norfolk, Birmingham, Houston, St. Louis, Chicago, Cleveland, Detroit, San Francisco, Washington, Pittsburgh, Seattle.

**BALDWIN**

**DIESEL ENGINES**

BLW THE BALDWIN GROUP

# ADJUSTABLE SPEEDS

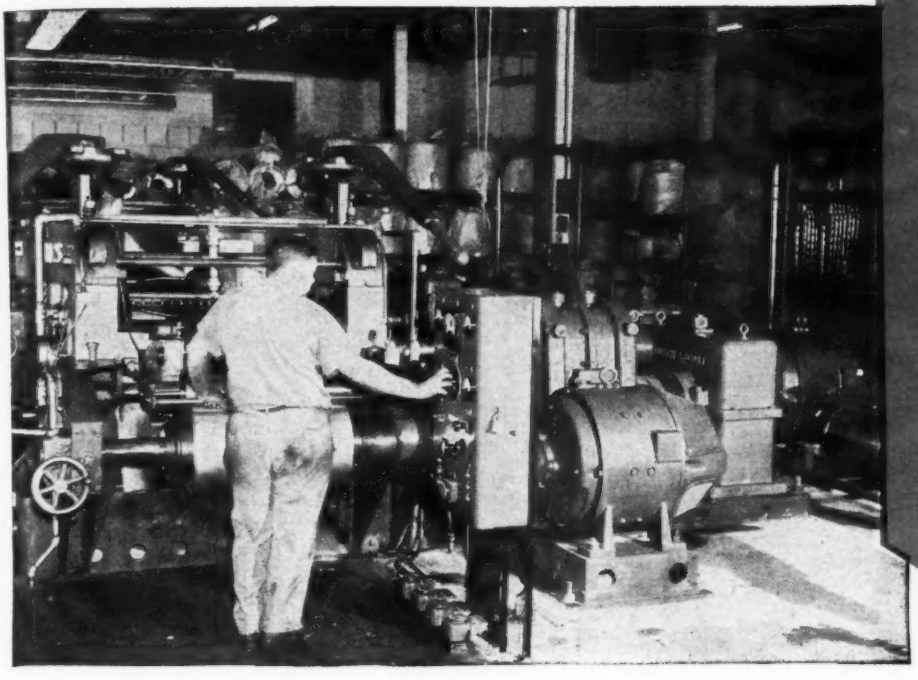
FROM A-c. CIRCUITS

*Plus*

**$25 to $60 SAVINGS**

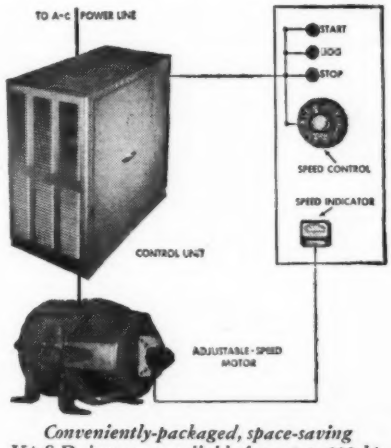
PER KILOWATT OF INSTALLED D-c. CAPACITY

*with*



RELIANCE V★S DRIVE

# RELIANCE V★S DRIVE




*Conveniently-packaged, space-saving V★S Drives are available from 1 to 200 hp.*

Reliance V★S Drive gives you all the flexibility of machine operation you need for faster, better, lower-cost processing. This means an infinite range of stepless speed changes, quick, smooth starts and stops, reversal at any point desired and maintenance of proper tension . . . all from A-c. circuits. And with these advantages, you reap the PLUS of $25 to $60 savings per Kilowatt capacity by installing the factory-wired, conveniently-packaged V★S Drive instead of bringing in and applying D-c. power from a central source. For more money-saving facts about the V★S Drive, call your nearest Reliance Representative or write for Bulletin 311-A.

**RELIANCE ELECTRIC & ENGINEERING CO.**
**1068 IVANHOE ROAD • CLEVELAND 10, OHIO**

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**RELIANCE A-C D-C MOTORS**

*"Motor-Drive is More Than Power"*

The problem of how to install steam generating equipment of sufficient output into limited plant space was easily solved by production engineers of a rubber tire plant. They installed a Wickes 2-Drum Boiler, similar to the sketch reproduced here, and now they're getting top boiler efficiency at low operating and maintenance costs. If you have a similar problem in your plant, it will pay you to investigate Wickes 2-Drum Boilers. They are made for large and small industrial installations. Capacities up to 250,000 lb. steam per hour, pressures to 650 psi. Adaptable to all methods of firing. Wickes manufactures all types of multiple drum boilers. For complete information, contact your nearest Wickes representative or write direct.

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver
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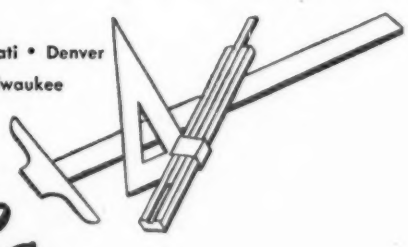
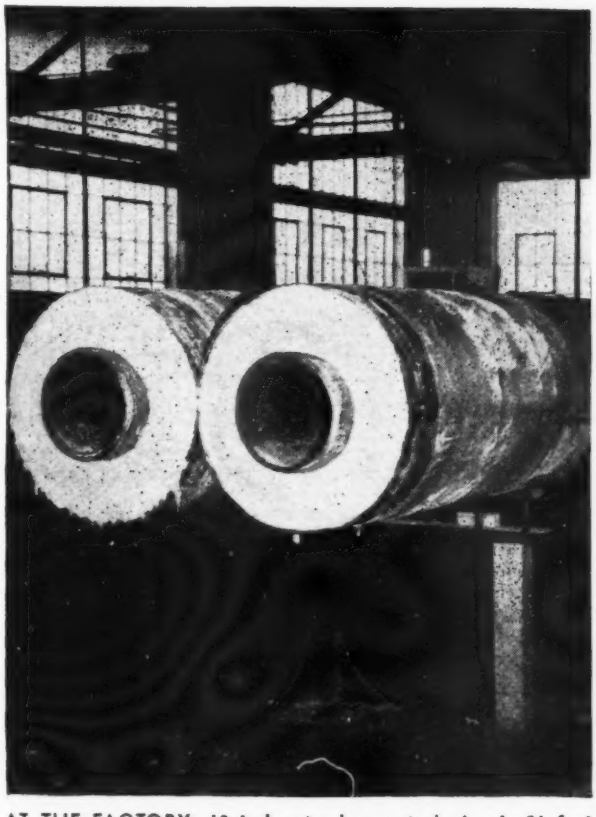


# The Wickes Boiler Co.

THE WICKES BOILER CO. • SAGINAW MICHIGAN, U. S. A. • RECOGNIZED QUALITY SINCE 1854

**RIC-WIL PREFABRICATED UNITS FORM UNDERGROUND SECTIONS OF MILE-LONG TIE-LINE SUPPLYING 200,000 LBS. MORE STEAM PER HOUR WITH NO INCREASE IN BOILER EQUIPMENT**



AT THE FACTORY: 10 inch extra heavy steel pipe in 21 foot lengths was covered with 3½ in. thick high-temperature insulation and encased in 16 gauge corrugated galvanized iron conduit.

● In the Rochester Gas & Electric Corp.'s new tie-line, steam is transmitted through the business district at 650 PSI, 750° F., one of the highest pressures ever maintained under city streets. Carried at this pressure for a distance of approximately a mile, the steam is fed through a desuperheating station and reduced to 250 PSI, 500° F. before entering the distribution system. With this tie-line, which utilizes excess steam capacity from one generating plant to serve additional customers of another, the utility company struck a happy balance between supply and demand. Service was extended without the necessity for new building construction or new boiler equipment. Ric-wiL Insulated Pipe Units, prefabricated at the factory to meet the specific requirements of this tie-line, provided ease and speed of installation.

***If you have an underground or overhead pipe distribution problem, write for complete information.***

**RIC-WIL**

INSULATED PIPE CONDUIT SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, OHIO

CABLE ADDRESS: RICWIL, BENTLEY'S CODE

# ROTO WATER JET

## *The most powerful and economical water-driven tube cleaner ever built*

No other water-driven tube cleaner develops such great power, and so economically, as the new ROTO Water JET. It is, by far, the most powerful and economical water-driven tube cleaner ever sold.

The ROTO Water JET motor is brand new in design and construction. With equal water consumption, it develops over 100% more horsepower than the old Roto water-driven motor. This increased power and efficiency gives you, for the first time, a water-driven tube cleaner that removes the most stubborn scale quickly and thoroughly.

ROTO Water JET motors are available for the most popular tube sizes. Other sizes will be available shortly. Existing Roto heads and hose fit the new ROTOJET motors.

The new ROTO water JET will save you enough on labor and water alone to pay for itself on a single tube cleaning job. And that's not figuring what you'll gain by putting your unit back on the line hours sooner.

Send for details and prices.

ROTO Water JET Motor Model 321 with short 4#arm head and universal joint for 2¼" I.D. straight tubes.

*And*

*If Compressed Air Is Available*

Get the most powerful and economical tube cleaner of all.

*The New* **ROTO Air JET**

**ROTO Division of ELLIOTT COMPANY**
153 SUSSEX AVENUE - - - NEWARK 1, N. J.

# "Mighty little maintenance with that diesel!"

Rock-bottom service and maintenance costs are the usual experience with Fairbanks-Morse Diesels.

These great engines have made outstanding performance records in every kind of industrial service... under every imaginable condition. Again and again, their stamina, their ability to stand up through years of heavy-duty service, has asserted itself.

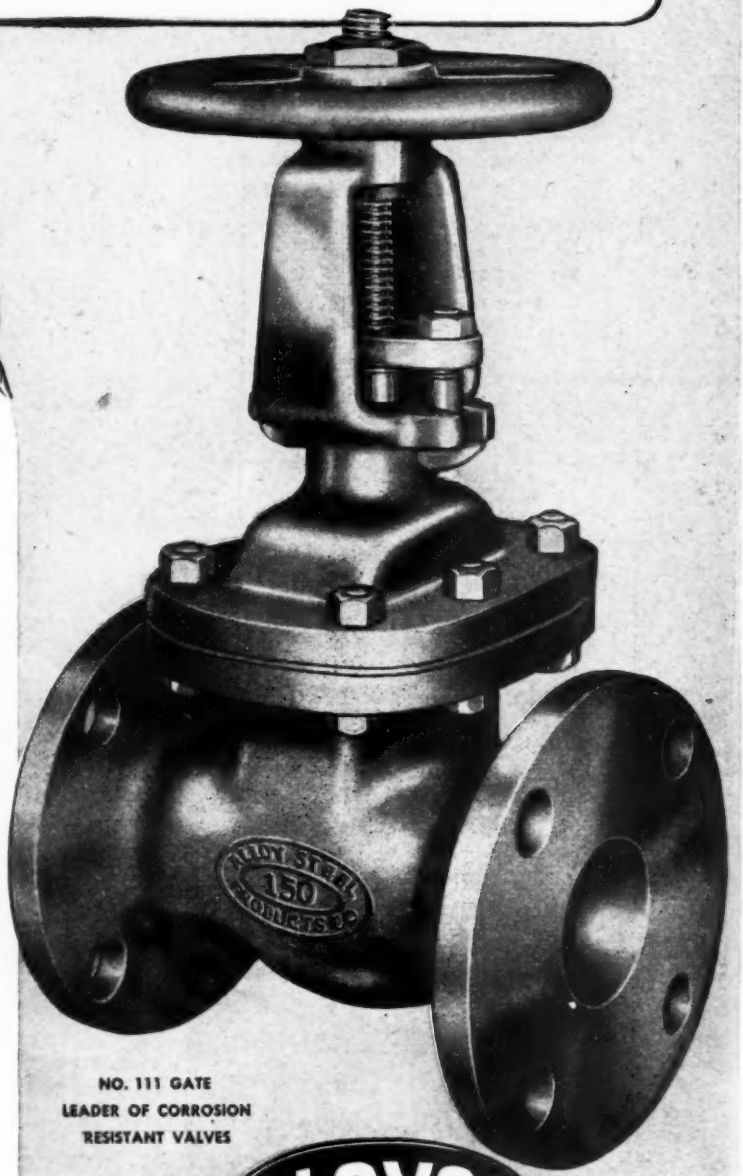
Yes, there's convincing proof of Fairbanks-Morse Diesel operating economy —and there's every reason you, too, will use these diesels with complete satisfaction. Why not write today for details? Fairbanks, Morse & Co., Chicago 5, Illinois.

# Fairbanks-Morse

***A name worth remembering***

**Diesel Locomotives • Diesel Engines • Generators**
**Motors • Pumps • Scales • Magnetos • Stokers**
**Railroad Motor Cars and Standpipes • Farm Equipment**

# We have never repaired an ALOYCO VALVE!




NO. 111 GATE
LEADER OF CORROSION
RESISTANT VALVES

The pipe shop foreman of a large chemical concern tells us:

"In my job I certainly have had headaches due to our use of valves in chemical lines. We have one man in our shop who does nothing but repair valves. He says he is able to call some of them by their first names. Their last name, by the way, is not Aloyco.

Our first Aloyco, a 1" Figure No. 111, was installed December 19th, 1941, in our toughest spot. This valve has been out three times for inspection and tests and each time was reinstalled without any repair. In the last year Aloycos have been going in fast. We have never repaired an Aloyco. My valve repairman can, in the future, be used on other work, thanks to your good stainless steel valves."

We hear many comments like this. The general excellence of Aloyco Valves is easy to understand. It is merely the result of concentration of our manufacturing activities on valves made of stainless steel and related corrosion resisting alloys. We make nothing else.

Our new catalog, containing comprehensive information on corrosion resistant Aloyco Valves will be sent to anyone who purchases, specifies or maintains valves and fittings handling corrosive solutions. Write today on your company letterhead.

ALOYCO

STAINLESS STEEL
VALVES AND FITTINGS

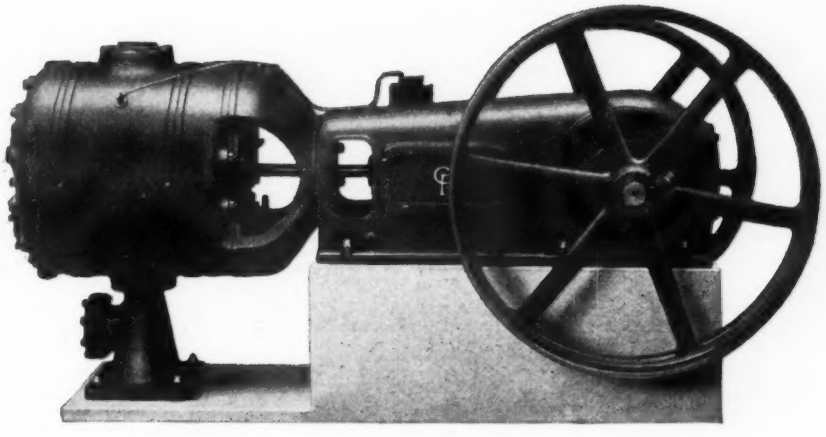
GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED AND FLANGED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

1403 WEST ELIZABETH AVE. • LINDEN, N. J.

# AUTOMATIC WATER RELIEF

## *protects CP dry vacuum pumps—*



• One of the discharge assemblies in each end of the cylinder of a CP Horizontal Vacuum Pump is arranged as a special automatic valve. Should a slug of liquid be accidentally drawn into the cylinder the relief valve assembly will lift off its seat against a heavy spring, providing extra escape area for the liquid and minimizing the danger of damage to the pump. This is an exclusive CP feature.

The durable Simplate Valves are located in both cylinder heads parallel to the piston face, affording low valve clearance and high volumetric efficiency at high vacua.

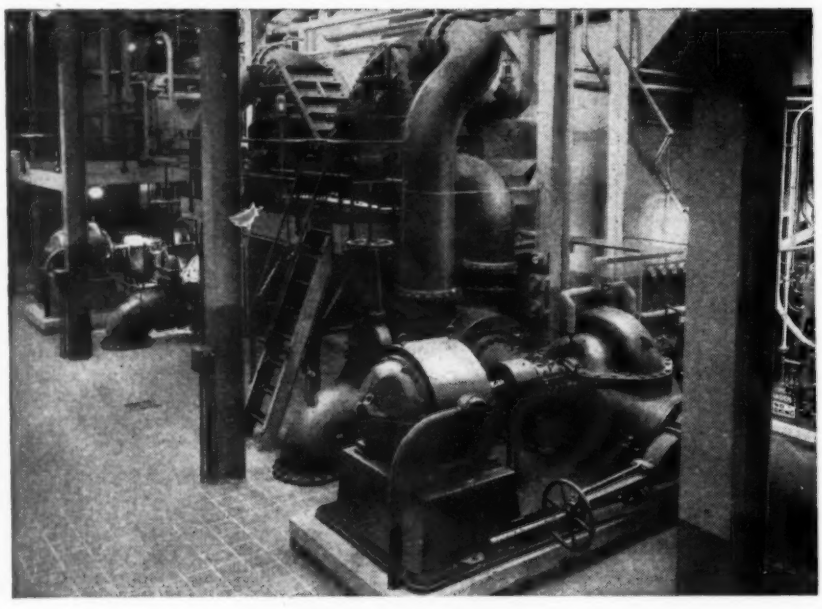
Arranged for belt, motor or steam drive, CP Single and Duplex Horizontal Dry Vacuum Pumps are available in capacities up to 15,000 c.f.m. Two-stage pumps available for very high vacua. Write for complete information.

**CHICAGO PNEUMATIC TOOL COMPANY**

**General Offices: 8 East 44th Street, New York 17, N. Y.**

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

# JENNISON STATION HAS MANY NEW POWER PLANT DEVELOPMENTS

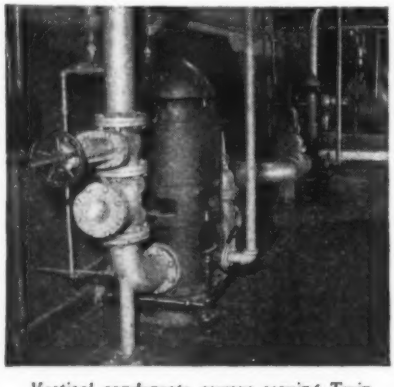


*General view of Twin H condenser and circulating water pump. The pump is one of two that are rated at 11,325 gpm against 35 ft head.*

## *Ingersoll-Rand Twin Condenser and Vertical Condensate Pumps Serve 30,000 K.W. Generator*

The Jennison station of the New York State Electric and Gas Company, designed and constructed by Gilbert Associates, Inc., was put into operation in December 1945. As one of the first central stations to go into service after V-J Day, it is an outstanding example of many new developments in the power field.

The 30,000 kw hydrogen cooled turbine-generator operates at 650 psi steam pressure and 825°F. Steam is exhausted from the turbine into an Ingersoll-Rand Twin H surface condenser served by I-R circulating pumps. The twin construction of the condenser was developed to meet the severe headroom limitations in the Jennison station. This design is new to central station practice, but it is not without precedent as it has been used many times with marine power plants where space is always at a premium. Basically the Twin H consists of two standard heart-shaped condensers mounted side by side and connected to a common steam dome. It is vertically divided to permit operation of either half while the other is shut down for inspection or cleaning. Two-stage, twin-element I-R steam-jet ejectors evacuate air from the condenser. Besides solving a headroom problem the Twin H also proved to be a manpower saver for the field erection crew. Its twin design permitted each half to be shipped completely assembled. Field welding and installation of tubing were eliminated—saving many hours on the job.



*Vertical condensate pumps serving Twin H condenser. Each is rated at 570 gpm against a 200 ft head.*

The condensate pumps are another new development. Their vertical design gives them a higher suction head than the usual horizontal unit minimizing the possibility of vaporization inside the pump. They are rated at 570 gpm against a 200 ft head.

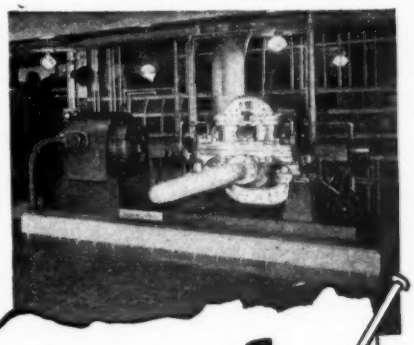
### *I-R Boiler Feed Pumps and Compressors Also Serve Station*

In addition, there are three Ingersoll-Rand heavy-duty, high-head boiler feed pumps. Two are motor driven and the third, a stand-by pump, can be driven by either motor or steam turbine.

Other I-R equipment in the Jennison station consists of two "non-lubricated" compressors that supply oil-free air for operating instruments such as feed water regulators, drainers, and the combustion control system; and a two-stage horizontal centrifugal sluice pump for transferring the water-quenched ash to the sump.

The selection of one manufacturer for the complete condenser plant and auxiliaries has resulted in giving the Jennison station the benefit of unified engineering along with the most recent developments in condenser, pump and air removal equipment. This plant is typical of the continuous research, sound engineering, and careful attention that Ingersoll-Rand devotes to the needs of utilities and industrial power plants. If your plans for tomorrow's increased power needs are ready to be put to work, call in Ingersoll-Rand specialists. They are ready to work with you.

*One of two heavy duty, high head boiler feed pumps. These are 6-stage centrifugal pumps each having a capacity of 475 gpm at a head of 2120 ft.*



**Ingersoll-Rand**

11 Broadway, New York 4, N. Y.

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# How Many Spare V-Belts Do You Really Need?

***With only four reels of Veelos, he has a choice of 316 standard sizes.***

WHEN Veelos on reels goes into a stockroom, a costly mass of many-size endless V-belts is eliminated. Four reels of Veelos, the link V-belt, provide replacements for as many as 316 sizes.

Do you require less? From a single 100-foot reel of Veelos any length V-belt can be quickly uncoupled, made endless and installed. You need *not stock even one* spare endless V-belt. There is none to age and deteriorate. With Veelos on reels, desired belt lengths are always available, easy to locate. Stock records are simplified... storage space saved.

Veelos is available in all standard sizes, fits all standard grooves, is packaged on standard 100-foot reels. Ask about the many, exclusive advantages of Veelos on reels.

Over 300 Veelos distributors and sales engineers located in principal cities to serve you.

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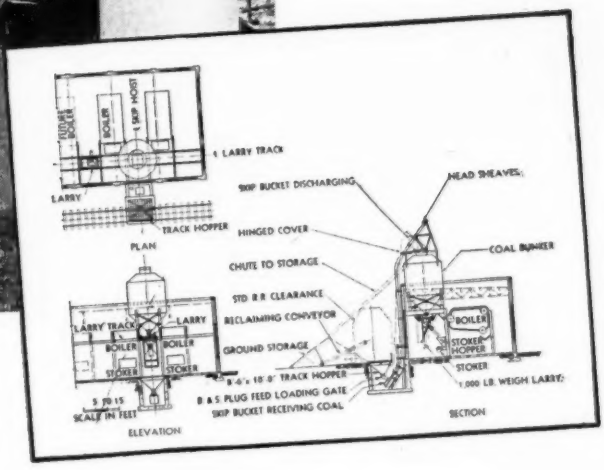
*THE LINK*
**V-BELT**

**Adjustable to any Length**
**Adaptable to any Drive**

***Tested, Proved and Adopted by American Industry***

**Known as VEELINK outside the United States**




# SYSTEMATIZED INDUSTRIAL COAL HANDLING

## proven design—quicker delivery—lower cost

● Incorporating the best ideas from our best jobs, and more than 40 years experience in this work, Bartlett-Snow Systematized Coal Handling arrangements meet the requirements of 95% of industrial plants handling less than 300 tons of coal per day. The systems combine maximum dependability with low operating and low maintenance costs,—can be installed in existing or new buildings, and altered easily to meet different yard and track conditions. Since the design and engineering work has already been completed, and written off, finished costs are not only substantially less than jobs that are engineered from scratch, but also, shop fabrication can be started promptly resulting in quicker delivery. Send today for Bulletin No. 83. It gives full details.

## THE C. O. BARTLETT & SNOW CO.

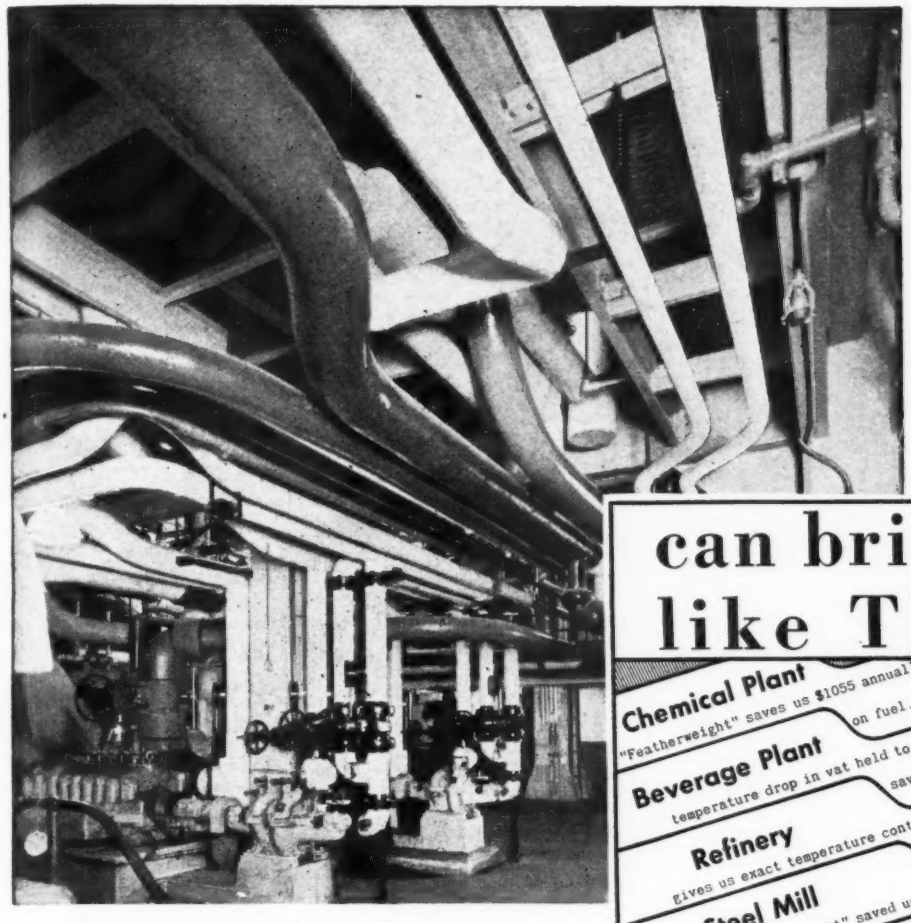
**6205 Harvard Avenue, Cleveland 5, Ohio**

**Engineering and Sales Representatives in the Principal Cities**

●

**COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS**

# . . . how the right INSULATION . . .



Condenser room of a large midwestern utility. As is customary in many plants, some of the lines have been painted to identify service.

## can bring results like THIS . . . .

**Chemical Plant**
"Featherweight" saves us $1055 annually on fuel. We are very pleas

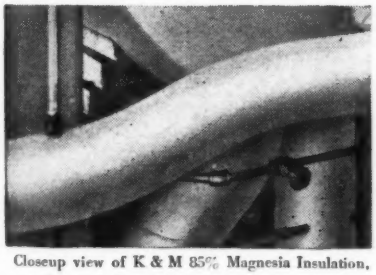
**Beverage Plant**
temperature drop in vat held to 19° in 64-hour weekend shutdown, saved us considerable time and fuel when we resumed.

**Refinery**
gives us exact temperature control, enormous fuel savings. In our plant this is a matter of vital concern.

**Steel Mill**
"Featherweight" saved us $1750 in one month. We expect to find similar savings in the months and years to come.

**Process Industry**
1,500,000 BTU's saved every day with "Featherweight" 85% Magnesia pipe insulation.
perature drop in vat he
ved us consi

## K & M "Featherweight" 85% Magnesia



Closeup view of K & M 85% Magnesia Insulation, complete with Canvas Jacket, on portion of piping.

You're sure to lower your fuel consumption, increase efficiency when you specify K&M "Featherweight" 85% Magnesia Insulation. You have more than just our word for it . . . actual performance under a wide variety of service conditions has *proved* "Featherweight" to be the most efficient insulation of the moulded type, for temperatures up to 600°F.

In "Featherweight," you get the structural strength of asbestos fibre and the insulating perfection of magnesia . . . a light-weight, durable, fire-resistant combination that will give you optimum service over an indefinite period of time.

K&M Distributors, located strategically throughout the country, are expert applicators of K&M insulation materials. Let them help you gain substantial savings in your plant. Write for full details.

*Nature made Asbestos . . .*

*Keasbey & Mattison has made it serve mankind since 1873*

K&M best in asbestos

Reg. U. S. Pat. Off.

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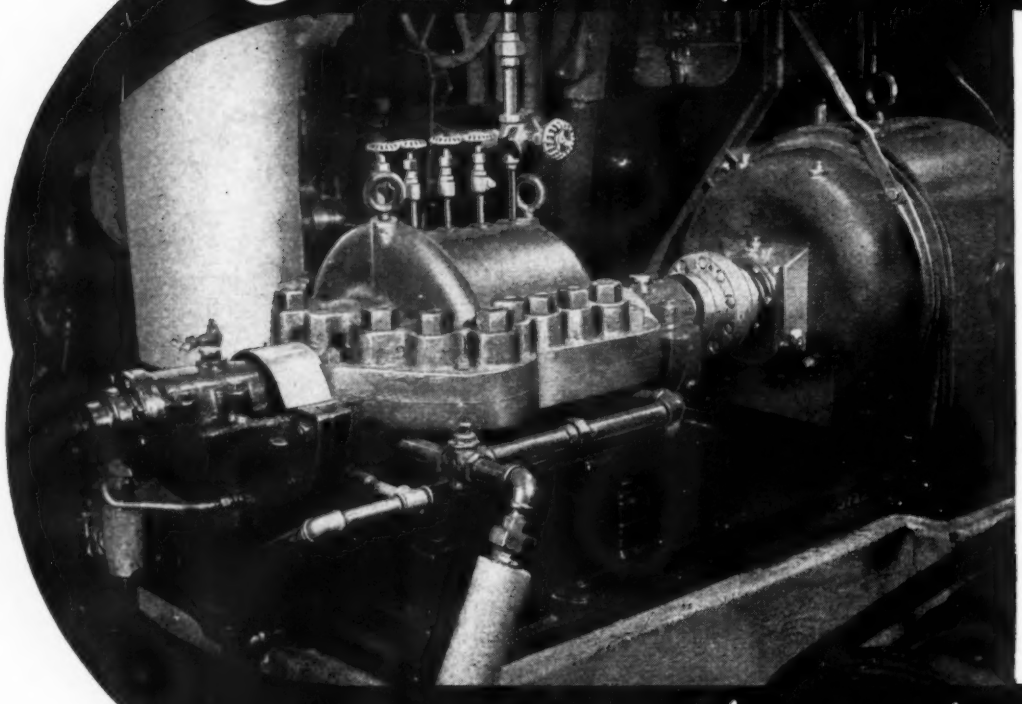
*IN CANADA*—ATLAS ASBESTOS CO., LTD. • MONTREAL, TORONTO, WINNIPEG and VANCOUVER

# *Hardly a sign of wear...*



*Can you match this record?*

This relatively small boiler feed pump, delivering 250 gpm against 513 psi, required no replacement parts or reconditioning after 45,000 hours of service.

# *...after 45,000 hours of service*

THE EXCELLENCE OF DE LAVAL design and construction is demonstrated by the performance of a De Laval boiler feed pump recently inspected after 45,000 hours of service in the municipal power plant of the City of Wyandotte, Michigan.

The following paragraph is quoted from the inspector's report:

"All machined surfaces of the case are in original condition. Diaphragms and balance arrangement fit neatly in all bores. Horizontal joint has no indication of leakage. Faces of rotating and stationary balance plates are in good condition; wear is approximately .005". Shaft sleeves are highly polished but are not worn or grooved. There is no leakage between shaft sleeve spacers and wheels. The shaft has no indication of contact with water. Wheel wearing rings show no indication of wear. No new parts were used in reassembling."

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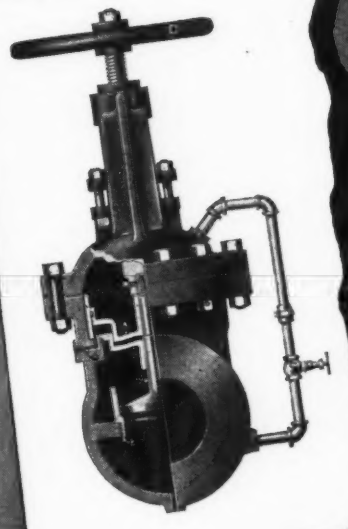
**DE LAVAL STEAM TURBINE COMPANY • TRENTON 2, N. J.**

BF-2

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

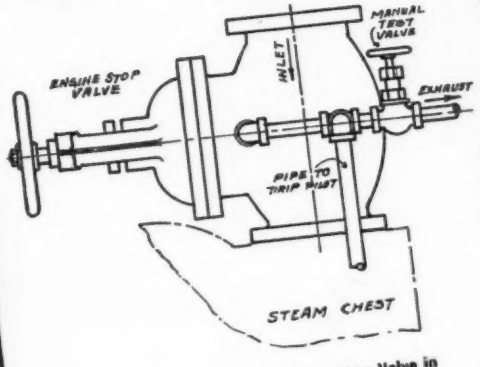
## HOW TO AUTOMATICALLY PREVENT

# TURBINE OR ENGINE OVERSPEEDING



## install

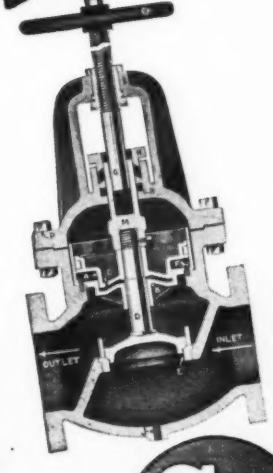
## GOLDEN-ANDERSON THROTTLE and AUTOMATIC ENGINE STOP VALVES




Golden-Anderson Throttle-Engine Stop Valve in horizontal position with downward steam flow.

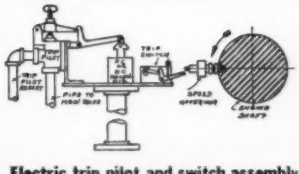
On overspeeding of engine or turbine the shaft governor may directly operate trip pilot control valve or limit switch, if solenoid trip pilot control is used, to open trip pilot control valve and permit engine stop valve to instantly close and stop engine or turbine.

By running down handwheel stem the valve may be closed any time, and by-pass valve should be closed when the valve is to be maintained in closed position over a period of time.

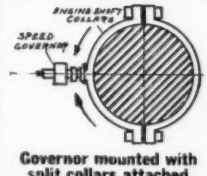



## *Free Engineering Aid...*

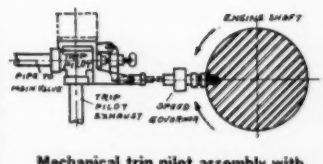
**Let GOLDEN-ANDERSON engineers help you on any new or replacement valve problem.**



Electric trip pilot and switch assembly with governor attached to engine shaft.




Governor mounted with split collars attached to engine shaft.




Mechanical trip pilot assembly with governor attached to engine shaft.

GA

**GOLDEN-ANDERSON**

**VALVE Specialty Company**

KEENAN BUILDING · PITTSBURGH 22, PA.

# ONE *recognized standard*

## THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

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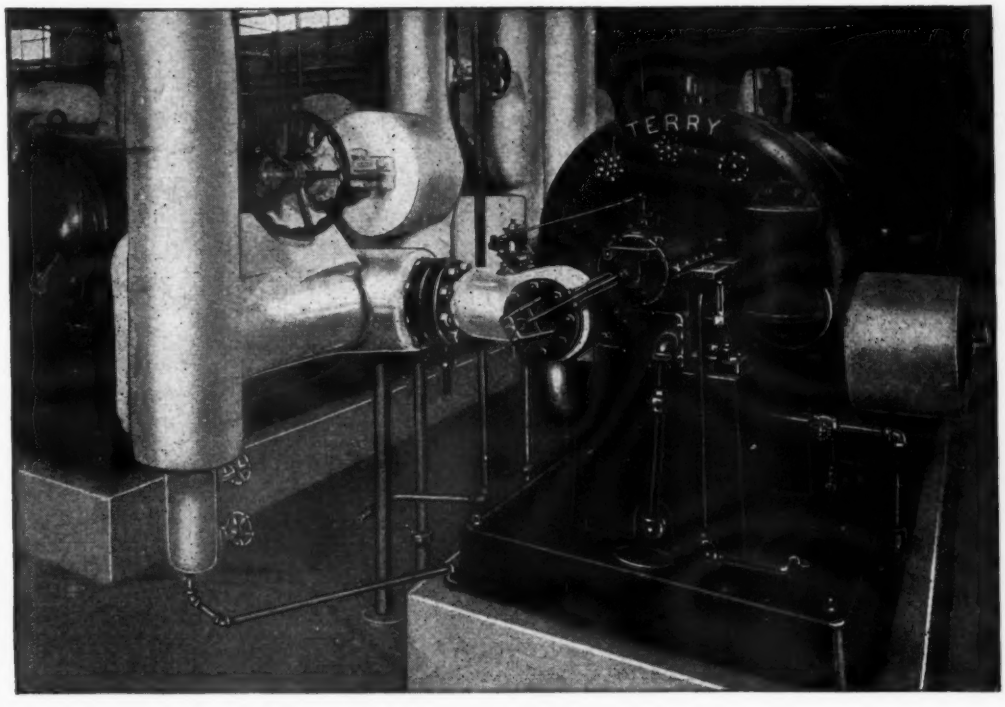
# TERRY



## GENEROUS BLADE CLEARANCES IN THIS 900° TERRY WHEEL TURBINE INCREASE DEPENDABILITY . . . .

The 290 H. P. Terry Turbine shown above is used for Boiler Feed Pump Drive in a recently completed central station. It operates with steam at 850 lbs.-900° F. and employs a Terry one piece wheel, as illustrated at the left.

The blades of this Turbine have large radial and axial clearances. They are further protected by projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. It is therefore impossible for the blades to foul.

The side clearance is very large - one inch - so that end play can do no damage.

Such construction makes for dependable operation.
- Descriptive bulletins sent on request. Ask for S-116.

T-1167

**THE TERRY STEAM TURBINE COMPANY**
**TERRY SQUARE, HARTFORD, CONN.**

# Too Busy on Wire Maintenance to Read This?

## You're Just The Man We Can Help!

If wire failures are a constant headache due to high ambient temperatures, overloads, deterioration caused by moisture, oil, grease, corrosive fumes and age . . . call in a Rockbestos engineer. He *can* and *will* solve your problem.

He'll give you the facts about Rockbestos A.V.C. wires and cables that guarantee long and trouble-free service under the toughest operating conditions because they are *permanently insulated* with heat and flame-resistant asbestos. This ageless insulator won't bake brittle, crack or flow in temperatures up to 230° F.

Hot spots shorten wire life and cause failures. Protect circuits around furnaces, pump rooms, boilers, kilns, soaking pits, steam tunnels and heat-exposed ducts with Rockbestos A.V.C. It pays its way by eliminating repeated re-wiring.

125 different standard Rockbestos wires and cables in 300 to 5000 volt ratings. Write for catalog and samples — or, if you prefer, the Rockbestos engineer nearest you will call with them.

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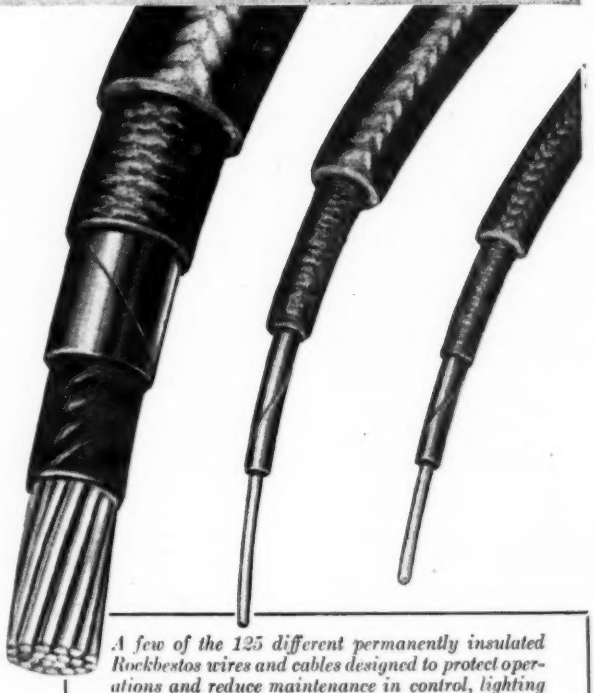
**193 Nicoll St., New Haven 4, Conn.**

# ROCKBESTOS A.V.C.

## *The Wire with Permanent Insulation*



*A few of the 125 different permanently insulated Rockbestos wires and cables designed to protect operations and reduce maintenance in control, lighting and power circuits. From left to right:*

Type AVA 600 Volt Rockbestos A.V.C. Power Cable*
Type AVA 600 Volt Rockbestos A.V.C. Boiler Room Wire
Type AVB 600 Volt Rockbestos A.V.C. Switchboard Wire
*Other single and multi-conductor cables up to 5000 volt rating.

NEW YORK BUFFALO CLEVELAND PITTSBURGH DETROIT CHICAGO ST. LOUIS
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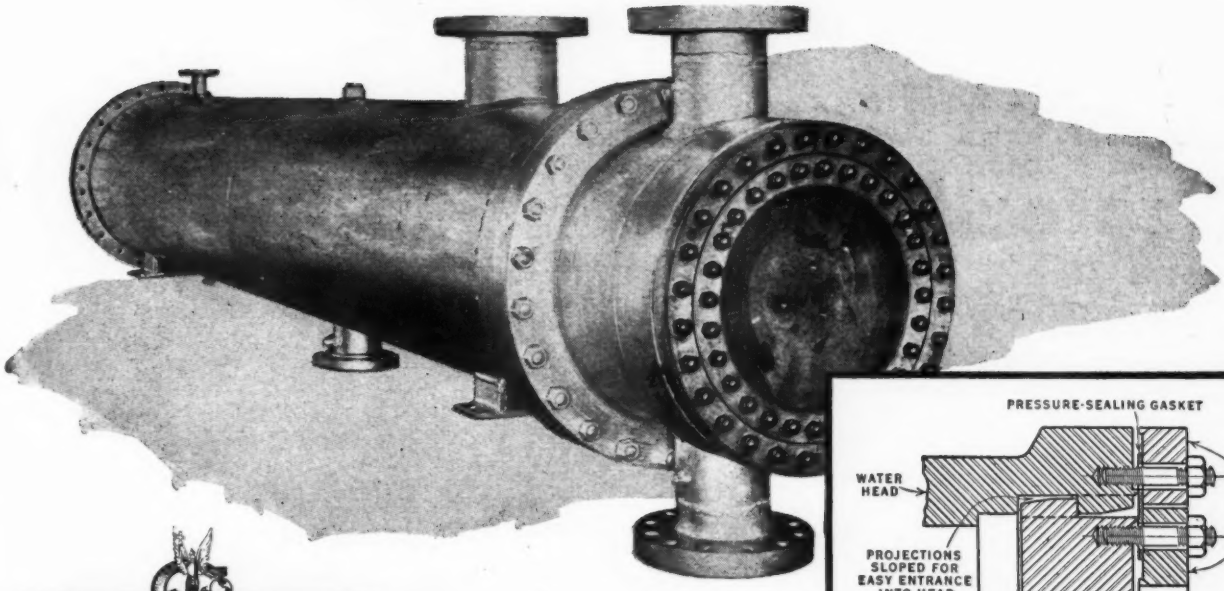
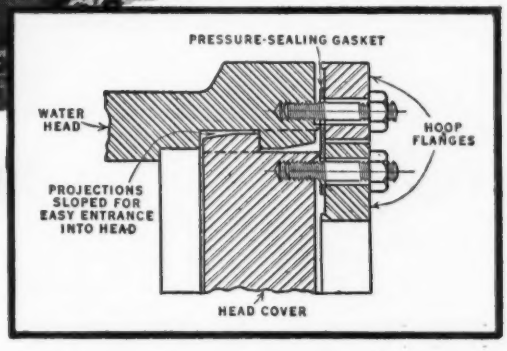
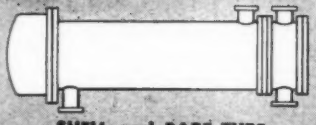





**ONLY G-R BUILDS THIS WIDE VARIETY OF HEAT TRANSFER APPARATUS**



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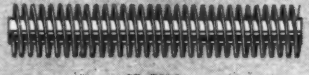
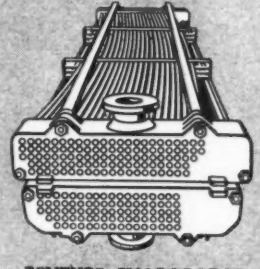
Heaters, Coolers, Condensers, Heat Exchangers

**G-FIN**
Longitudinal-finned elements for greater heat conductivity



**K-FIN**
Helical-finned elements for vapors and gases



**BENTUBE EVAPORATOR**
Scale-shedding Elements

**TUBEFLO SECTIONS**
Non-clogging design for residuum and other dirty fluids

# THIS EXTRACTION STEAM HEATER HEAD

## *has 4 important advantages*

***For high-pressure service, the G-R Type L Heater Head design provides the following 4 outstanding benefits not obtainable in any other designs.***

**NO HEAVY BOLTS**

The "breech block" arrangement of water head and cover transmits the hydraulic load to the barrel, and requires only a light pressure-sealing member to maintain a tight joint.

**VISIBLE PRESSURE SEAL**

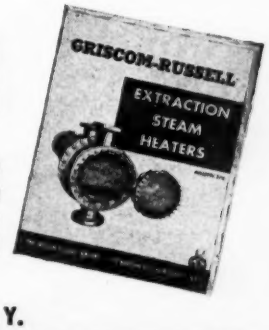
The pressure sealing joint is visible for inspection.

**ACCESSIBLE GASKET**

Gasket pressure is easily adjusted without dismantling the water head cover.

**READILY REMOVABLE HEAD COVER**

The water head cover is removed or replaced by a single tool, and by simply rotating it through a small angle equivalent to the width of the engaging "breech block" projections.



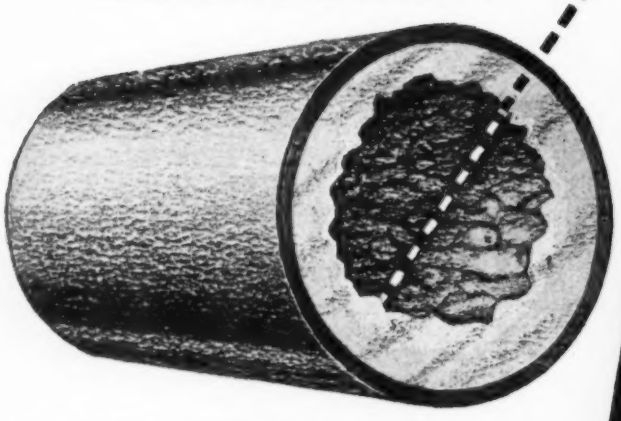

***These advantages and the other distinctive features of all the G-R Extraction Steam Heater designs for various pressures and capacities are described in Bulletin 278, which will be sent on request.***

**THE GRISCOM-RUSSELL CO., 285 Madison Ave., New York 17, N. Y.**

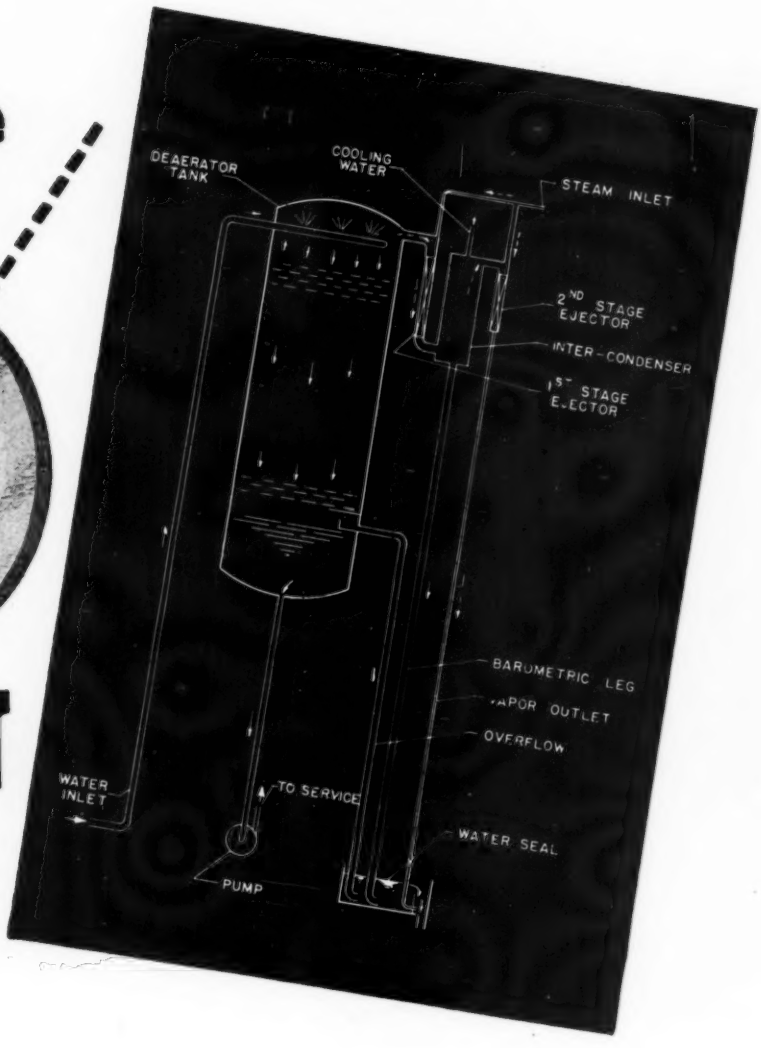
# GRISCOM-RUSSELL

*Pioneers in Heat Transfer Apparatus*

# For Pipe Line Protection



# LIQUON *Vacuum Deaerator*



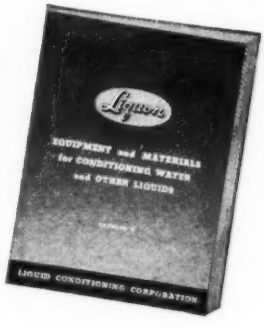

Oxygen . . . necessary for life . . . kills iron pipes!

Steel and cast iron pipe lines are badly corroded by oxygen in the water. This corrosion weakens the pipes, and at the same time builds up rust deposits which reduce the capacity of the lines. As a result, higher and higher pressures are required to force the original flow rates through the weakened pipes. In addition, rusty water is delivered, causing iron deposits in the cooling system.

To protect your iron piping and to avoid increased pumping costs, install a LIQUON Vacuum Deaerator, which thoroughly removes oxygen and other dissolved gases from the water.

In this unit, the water is broken up into thin sprays and films to permit the release of the dissolved gases. Since these gases will be released completely only at the boiling point, a vacuum must be maintained corresponding to the boiling point at the temperature of the cold water. A steam ejector or motor driven vacuum pump is used to produce this vacuum.

Write for Catalog G, describing the LIQUON Vacuum Deaerator and the many other different products and processes developed by LIQUON engineers to improve water quality. If your water supply has high hardness or alkalinity, or contains other impurities of any kind, consult these long-experienced water treatment specialists.




## LIQUID CONDITIONING CORPORATION

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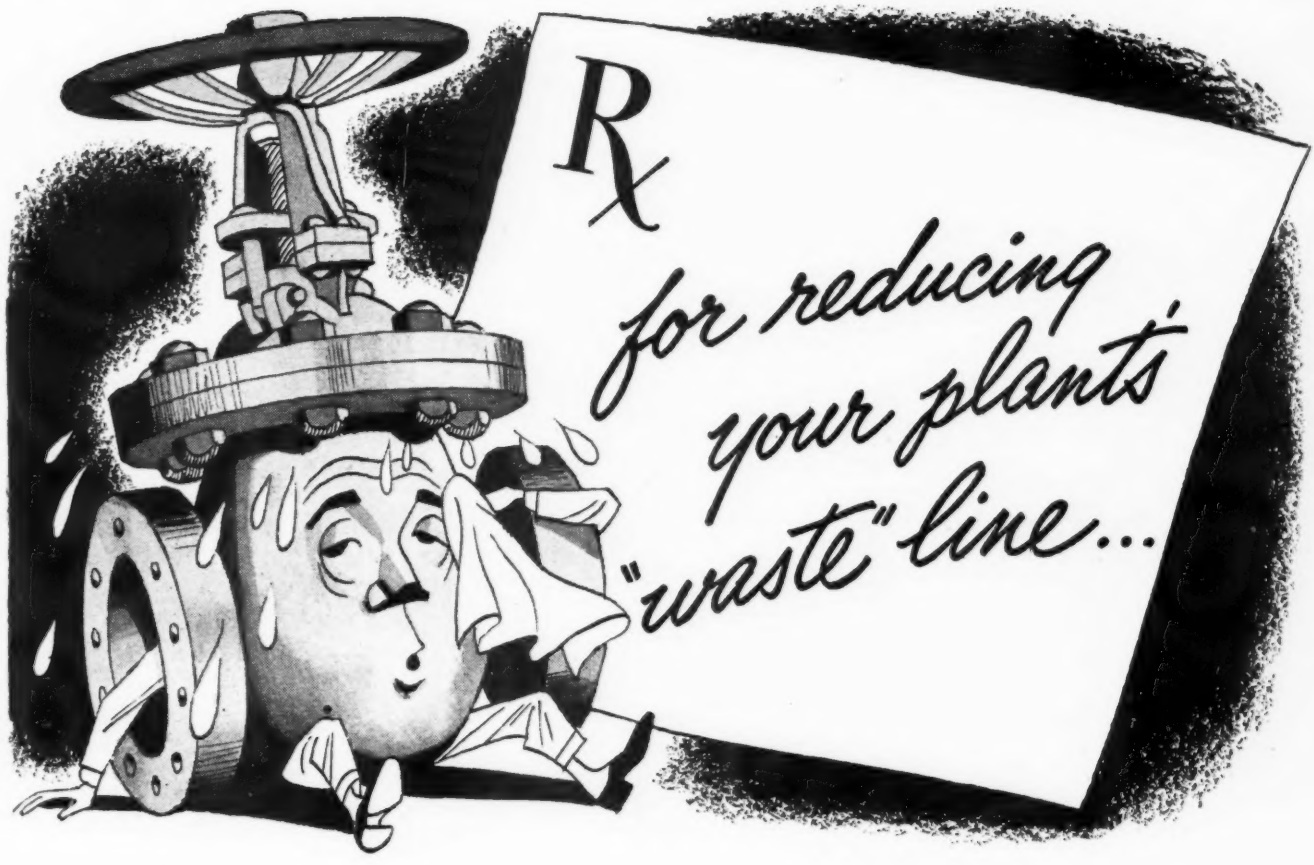
Liquon

EVERY PROCESS...EVERY TYPE OF EQUIPMENT
*for Conditioning of Water and Other Liquids*




## B-H No. 1 Insulating Cement makes it easy to keep BTU's where you want them

Here's the fast, efficient way to prevent fuel waste through the surface of valves, fittings and other irregular surfaces.

*Fast*—because you simply add water, mix and apply. B-H No. 1 sticks instantly—won't slide off bottom surfaces or roll up behind the trowel.

*Efficient*—because it's compounded of *Black* Rockwool—insulates up to 1800°F. For example, a 3-inch application reduces 800°F. surface temperature to 150°F.

*Other advantages:* B-H No. 1 doesn't crack or peel. A special rust inhibitor safeguards against corrosion, assures a permanent bond. Reclaimable up to 1200°F.

Check over the places in your plant where heat loss can be prevented. Then send for full information and a working sample of B-H No. 1 Cement.

**Baldwin-Hill**

*Specialists in Thermal Insulation*

Baldwin-Hill Company, 514 Breunig Ave., Trenton 2, N. J.

Send free sample of B-H No. 1 Cement and data book "Industrial Insulations"

Name..... Position.....

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# Soft...tough... ductile

SOFT...tough...ductile — that's Globeiron high purity ingot iron seamless tubing. Tubing that's ideal for severe forming operations—cold or hot. Its metal structure is uniquely uniform — almost pure ferrite. Its magnetic permeability is almost that of pure iron. You can weld it with any common method — no pre-heating or other precautions are necessary.

Globeiron is superior to many steels in corrosion resistance — in any applications wherever corrosive attack is accelerated by segregations and impurities in steels. It may be hot-worked in any temperature range without becoming brittle. Pressure tube requirements, where uniformity, ductility and purity of metal are essential, can best be met with Globeiron seamless tubing.

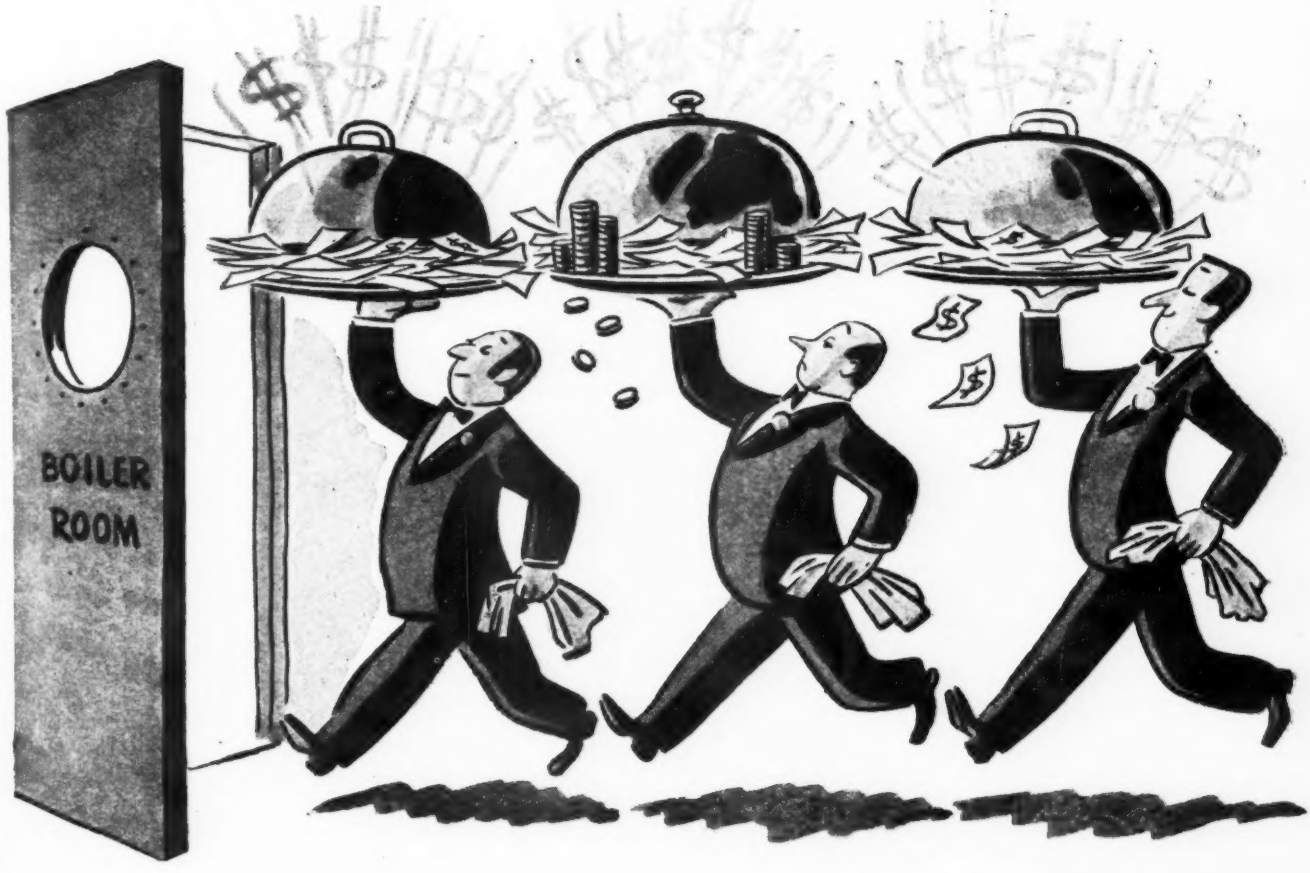
Globeiron is a product of Globe Steel Tubes Co. — a specialized, dependable manufacturing source for seamless tubing in carbon, alloy, stainless steels, and Gloweld welded stainless steel tubing.

Globe Steel Tubes Co. • Milwaukee 4, Wisconsin.

Globeiron
SEAMLESS TUBING

*Write for Globeiron Bulletins Nos. 109A and 113*

# Some "good" boilers eat too much




Your old boiler may still seem sound externally . . . still supply steam at a great rate . . . even pass insurance inspections easily. But does it generate steam *economically?*

Many boilers, new and old, eat up your profits in fuel and repair bills. Unless your boiler produces steam with the minimum fuel, *continuously* — chances are you'll save money by scrapping it.

By replacing your present boiler with a modern Preferred Unit Steam Generator you can often cut fuel bills as much as 40% . . . reduce repair bills that mount steadily as the years go by . . . avoid costly, unexpected shutdowns . . . eliminate excessive operator attention.

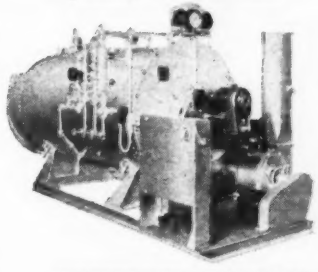
## WHY?

**Because the Preferred is the *only* factory-completed steam generator with *all* these features:**

**1** *Induced (Pull-through) Draft,* a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

**2** *Fully Automatic Operation* even with Bunker C, No. 6, including the new catalytic residuals.

**3** *Preferred Oil Burner* — built especially for this unit.



**4** *Four-Pass Gas Travel* results in maximum heat absorption.

**5** *80% Minimum Thermal Efficiency* proved and guaranteed.

**6** *Low Maintenance* — the result of over 27 years of combustion engineering experience.

**7** *Full Range of Sizes* from 40 to 500 H.P. and pressures up to 200 lbs. Two-Pass Units in 10-20-30 H.P. and pressures up to 125 lbs.

These features of the Preferred Unit Steam Generator add up to easier, more economical power plant operation for you. If you want complete details showing why the Preferred uses less fuel, requires less attention, send for our NEW Bulletin 1000-E.

P-5-47

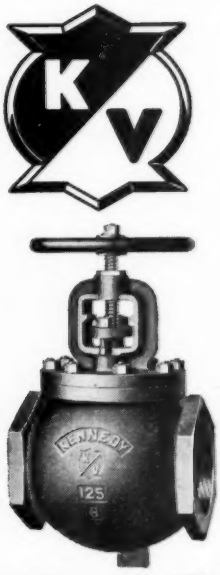
**PREFERRED UTILITIES MFG. CORP.**
**1860 BROADWAY, NEW YORK 23, N. Y.**

PR-143

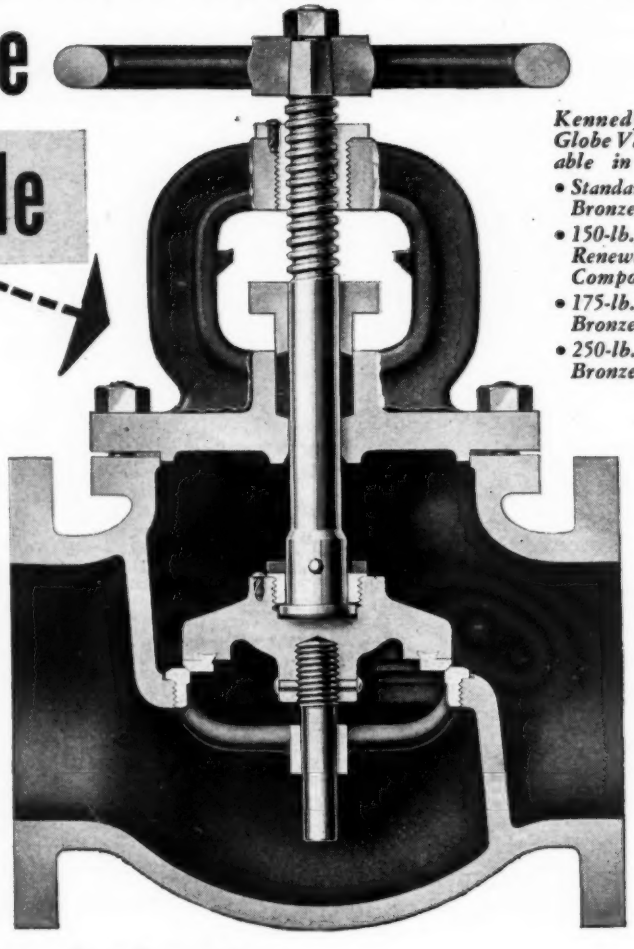
**PREFERRED UTILITIES MFG. CORP.**

PREFERRED UTILITIES — Pioneers for Results — ENGINEERED

This----------→ on the outside



means stamina on the inside



*Kennedy Iron-body Globe Valves are available in these types:*

- *Standard with Bronze-faced Discs*
- *150-lb., with Renewable Composition Discs*
- *175-lb., with Bronze-faced Discs*
- *250-lb., with Bronze-faced Discs*

The stamina you get in all Kennedy Valves is the product of experience, intelligent design and tough metal. Evidence . . . this Kennedy Iron-body Globe Valve. Note the generously proportioned body . . . the thick sections of dense, homogeneous, high-strength cast iron . . . the sturdy ribbed yoke.

These are but three of the many features you get when the name Kennedy is on the outside of the valve you buy. For the whole story on Kennedy Valves, write for the 240-page catalog describing the full Kennedy line of bronze and iron-body gate, globe, angle and check valves, pipe fittings, flanges and other valves and accessories.

• BUY FROM YOUR LOCAL DISTRIBUTOR

# KENNEDY

KV-149

## valves-pipe fittings-fire hydrants

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK *Offices and Warehouses in Principal Cities*

# Then there's the rule of *Thumb* method

. . . when scientific knowledge is replaced by instinct.

**It's a good rule to follow for some things, but totally inadequate for *efficient* boiler plant operation.**

**Correct water conditioning, for instance, is a matter of careful and scientific control.**

**W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . .**
**W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa.**
**In Canada: Betz Laboratories Limited, Montreal 1.**

# BETZ

**BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT**

# Load or Unload . . . REX-TUBE *does both . . . better!*

● REX-TUBE, Type RT-15, is the rugged, "made-to-order" interlocked flexible metal hose for working assignments like those shown above. Steel (or bronze) RT-15 is the standard flexible metal unloading hose. In addition to loading and unloading operations, it is widely used for *handling steam at low and moderate pressures; dispensing bituminous and other "hot" processed liquids* and other such services where manual usages of flexible metal hose are required.

There are other Rex-Tube types for a wide variety of applications. Sizes range to 12″ I.D. inclusive, with soldered or heat-proof couplings. Send for data sheet.

the science of FLEXONICS

* "The controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion"... is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH CHICAGO METAL HOSE CORPORATION

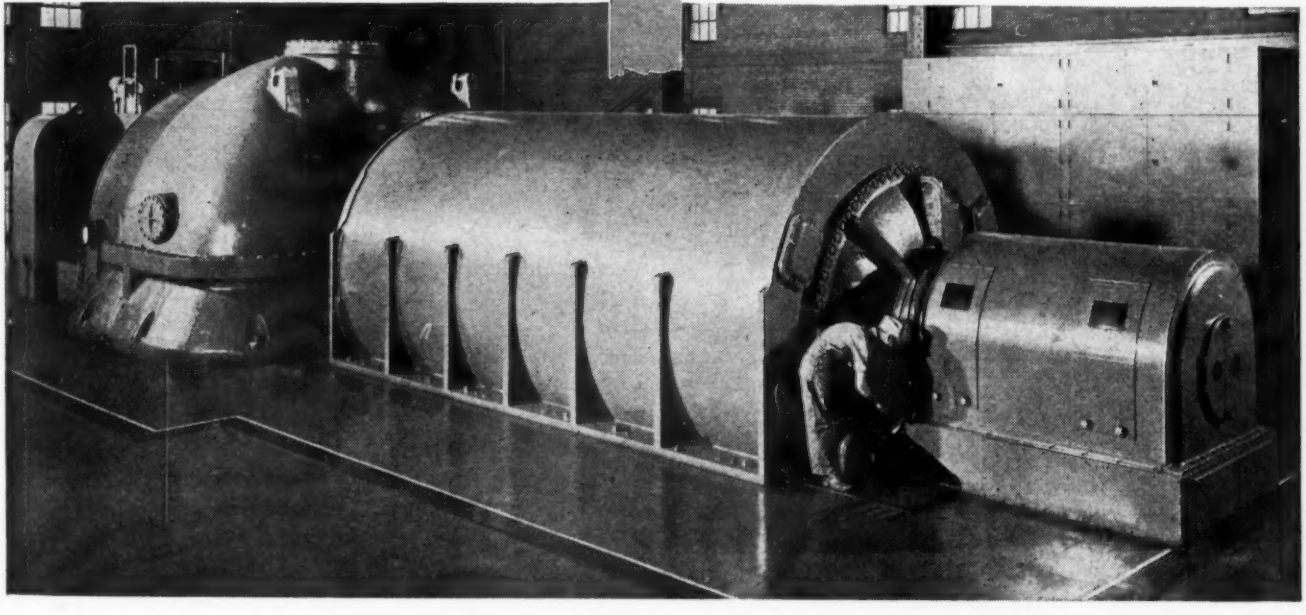
Maywood, Illinois • Plants: Maywood and Elgin, Illinois

# Do you have a turbine lubrication problem?

## GULFCREST WCR, the world's finest turbine oil, is the answer!

- _too frequent oil changes or too much make-up?
- _rust due to condensation?
- _steadily increasing neutralization number?
- _oil foaming?

- _lasts indefinitely
- _contains an effective anti-corrosion inhibitor
- _maintains a remarkably low neutralization number
- _is nonfoaming



EXTRA REFINING MAKES THE DIFFERENCE! Gulfcrest Oil is not only refined by conventional methods, but is superrefined by the Alchlor Process. That's why Gulfcrest is incomparably pure—why it gives outstanding performance.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of this superior oil to provide the best lubrication for your turbine. Write, wire, or phone your nearest Gulf office.

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Please send, without obligation, a copy of your booklet "Gulfcrest Oil for Steam Turbine Lubrication."
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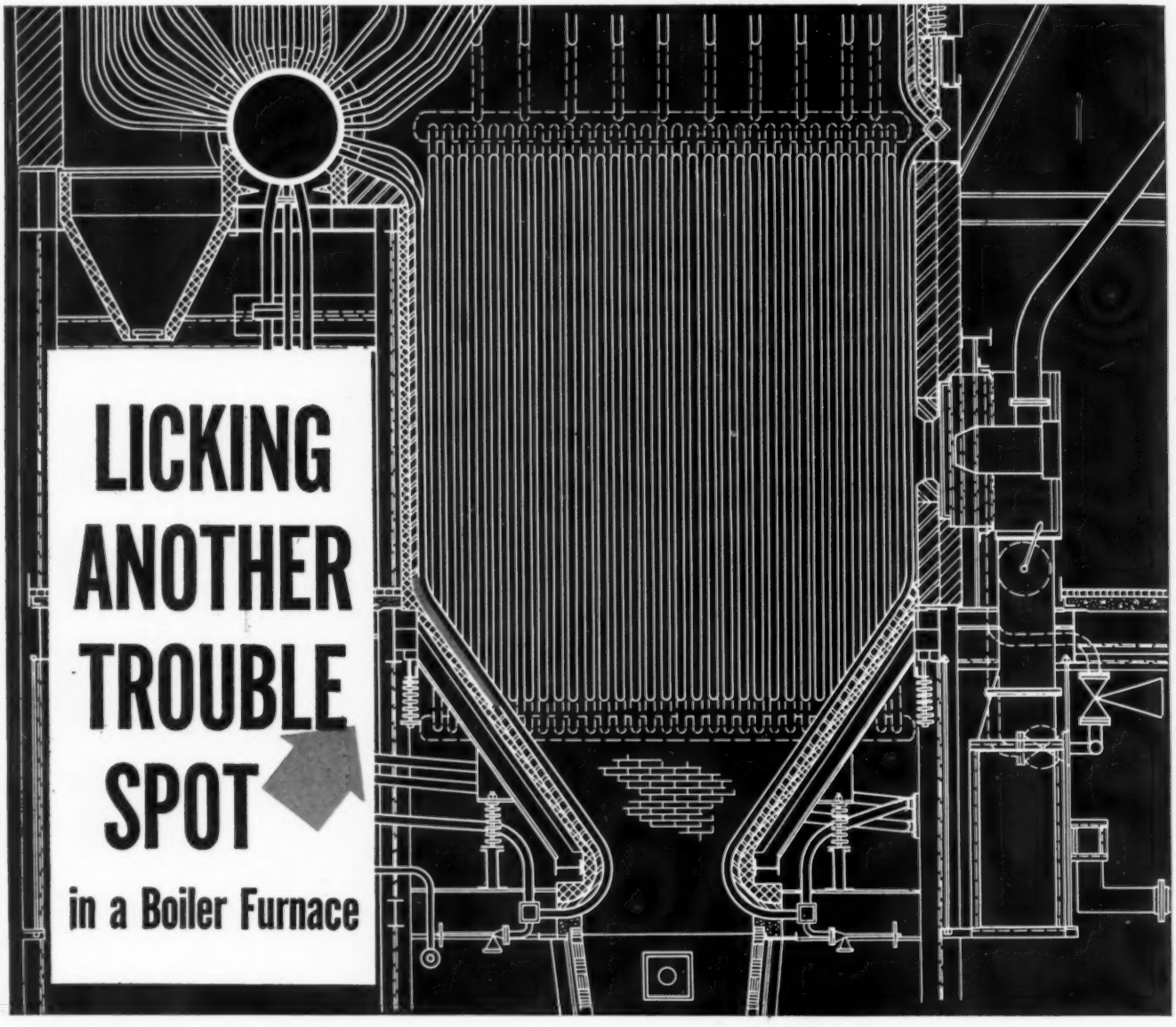



The small area, spotlighted in red above, was a source of constant difficulty until it was corrected by the installation of CARBOFRAX silicon carbide blocks.

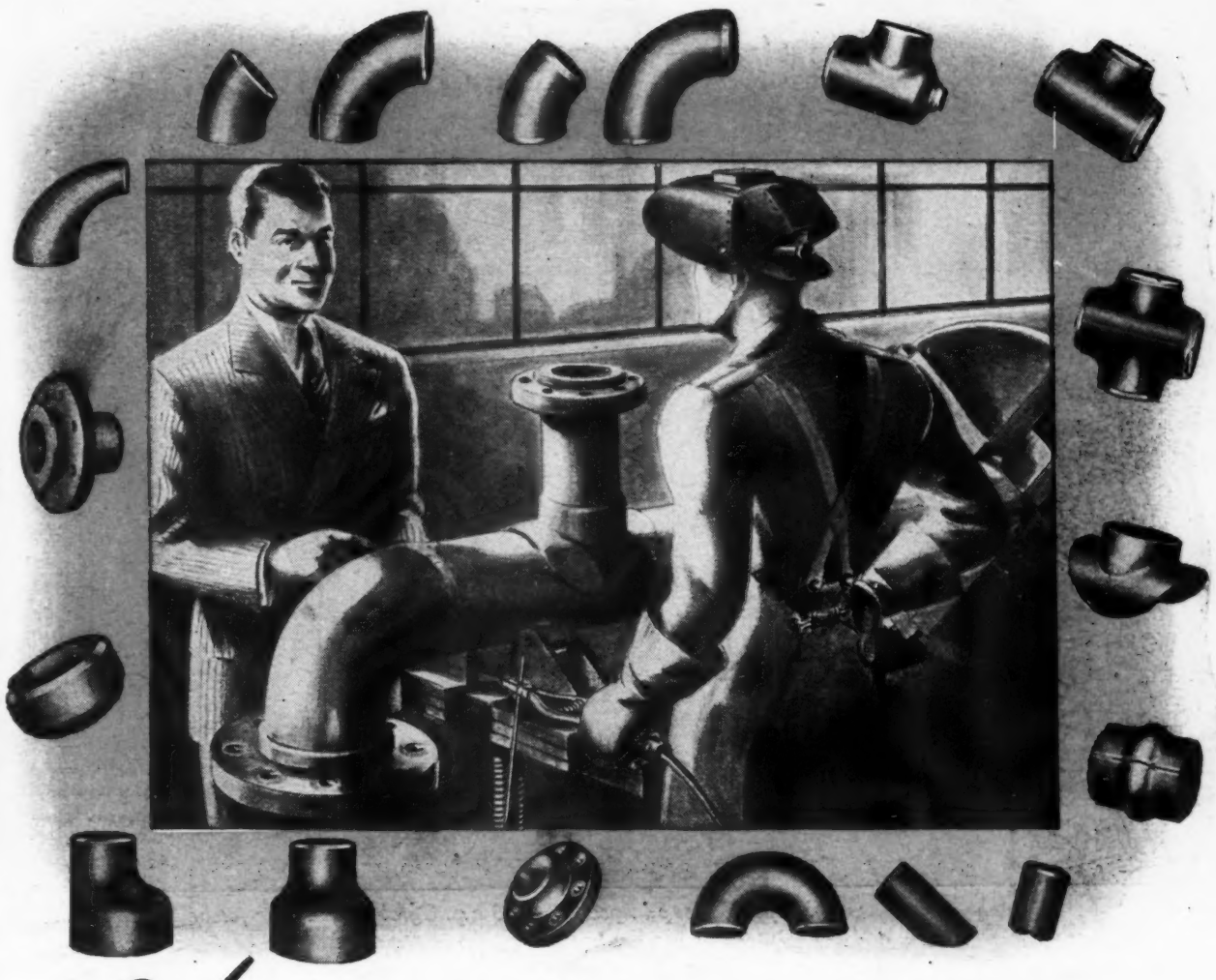
Slag conditions were particularly bad. Excessive accumulations built up on cast iron blocks located behind and between water tubes. Cleaning with air lances oxidized the metal blocks. Burning thin, they no longer protected backing up refractories and insulation which were soon eroded by impinging flame.

*CARBOFRAX blocks have now been in service over four years, more than twice the life of metal blocks. Their appearance indicates more years of usage.* Costly repairs are eliminated by their outstanding refractoriness... resistance to slag penetration and erosion... and durability. Continuity of operation is improved. When running on light loads, the radiant face of CARBOFRAX blocks helps maintain ignition.

Trouble spots, in many cases, disappear with CARBOFRAX super refractories on the job. Investigate their use in your settings. Our engineers will be glad to assist. Write Dept. G-67 for prompt attention. The Carborundum Company, Perth Amboy, New Jersey.

BY **CARBORUNDUM**
TRADE MARK

*"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company*



*Ask* **THE WELDER OF PRESSURE PIPING**

*what he thinks of*

# MIDWEST WELDING FITTINGS

You will find that he gives them hearty approval. Piping welders generally have a high appreciation of the exceptional dimensional accuracy and uniformity of Midwest Welding Fittings . . . their job is easier and they can turn out better work faster.

Midwest Welding Fittings have extraordinary dimensional accuracy because particular precautions are taken in their manufacture. Midwest Welding Elbows, for example, are made slightly oversized, then reheated to forging temperature and given a final accurate sizing in compression. This provides accurate dimensions, true circular section, and uniform wall thickness. Comparative corrosion tests as well as tensile and ductility tests have proved the beneficial effect of forging the metal in compression.

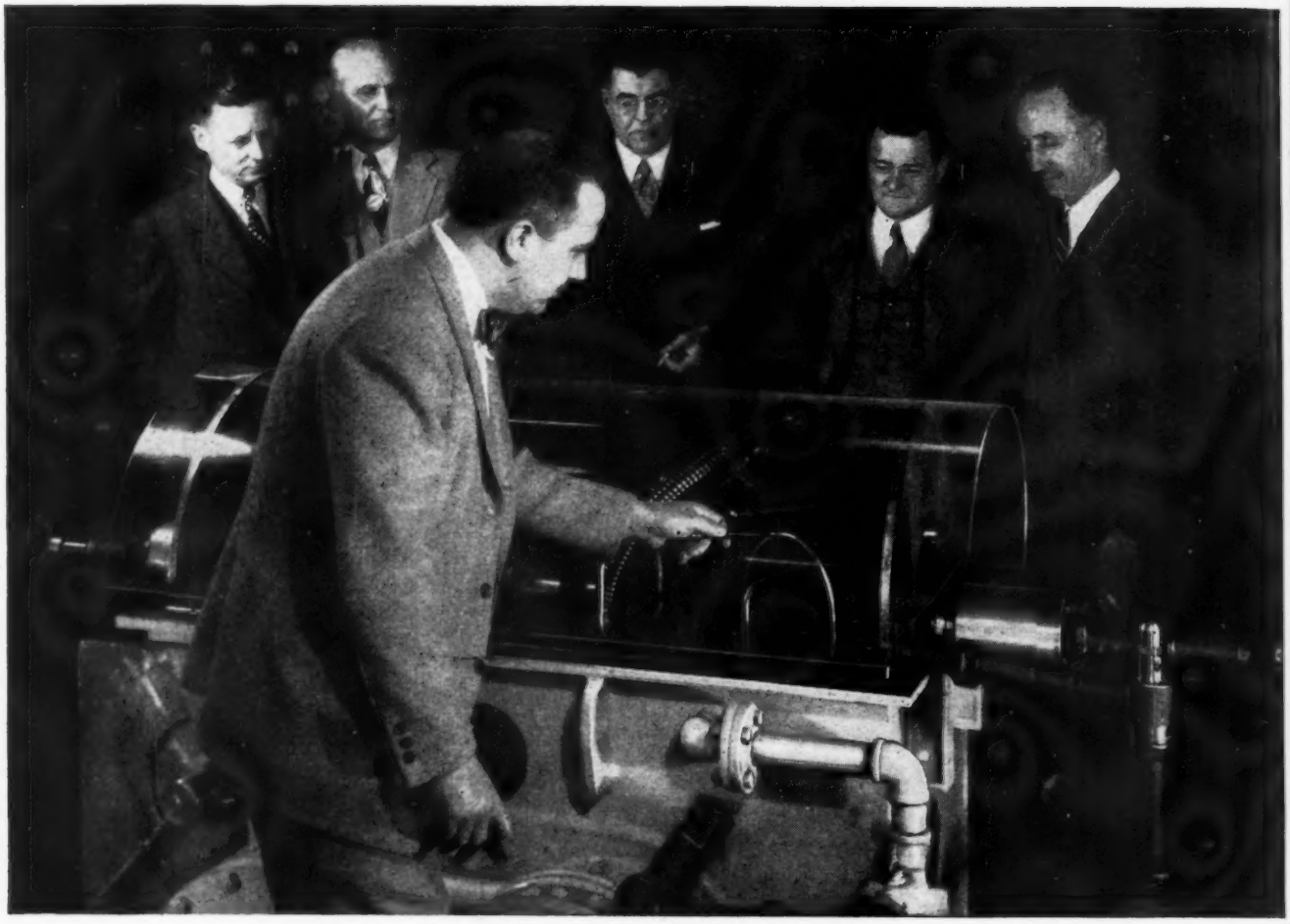
Welders also appreciate the wide variety of Midwest Welding Fittings . . . including "Long Tangent" elbows and reducing elbows. There is a fitting for practically every condition he encounters. Ask the local distributor or our nearest office for Bulletin WF-41.

MIDWEST

**PIPING & SUPPLY COMPANY, INC.**

**Main Office: 1450 South Second St., St. Louis 4, Mo.**

**Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities**



*Interested group inspecting 2,000 h.p. Gýrol Fluid Drive for boiler feed pump duty.*

# Power Saver for Power Producers

YOU'RE hearing a lot these days about Gýrol Fluid Drive—and the rapidly growing use of this method of stepless speed control for boiler feed pump systems.

A point that's emphasized time and time again: ***Gýrol Fluid Drive saves power****—lots of it!

The stepless, infinitely adjustable speed control of the Type VS Class 6 Fluid Drive is especially valuable in boiler feed pump operation. Here is the quick, easy control capable of the fine increments of speed adjustment required in the narrow speed range over which a boiler feed pump must operate.

Often, too, Gýrol Fluid Drive permits in high pressure boiler installations a pressure reduction of 500 lbs. and more, at reduced flows. Of course, this lowers the duty demand on piping, high pressure heaters and valves—prolongs pump life.

If you are planning a new steam generating unit or modernization—we are sure you'll be interested in our Bulletin 8019. This bulletin is devoted exclusively to the use of Gýrol Fluid Drive for boiler feed pumps. Ask the nearest American Blower Branch Office for your copy or write direct.

***See Bulletin 8019 for boiler feed pump performance curve that illustrates typical savings.**

***For better performance get —***

GÝROL *Fluid Drive*

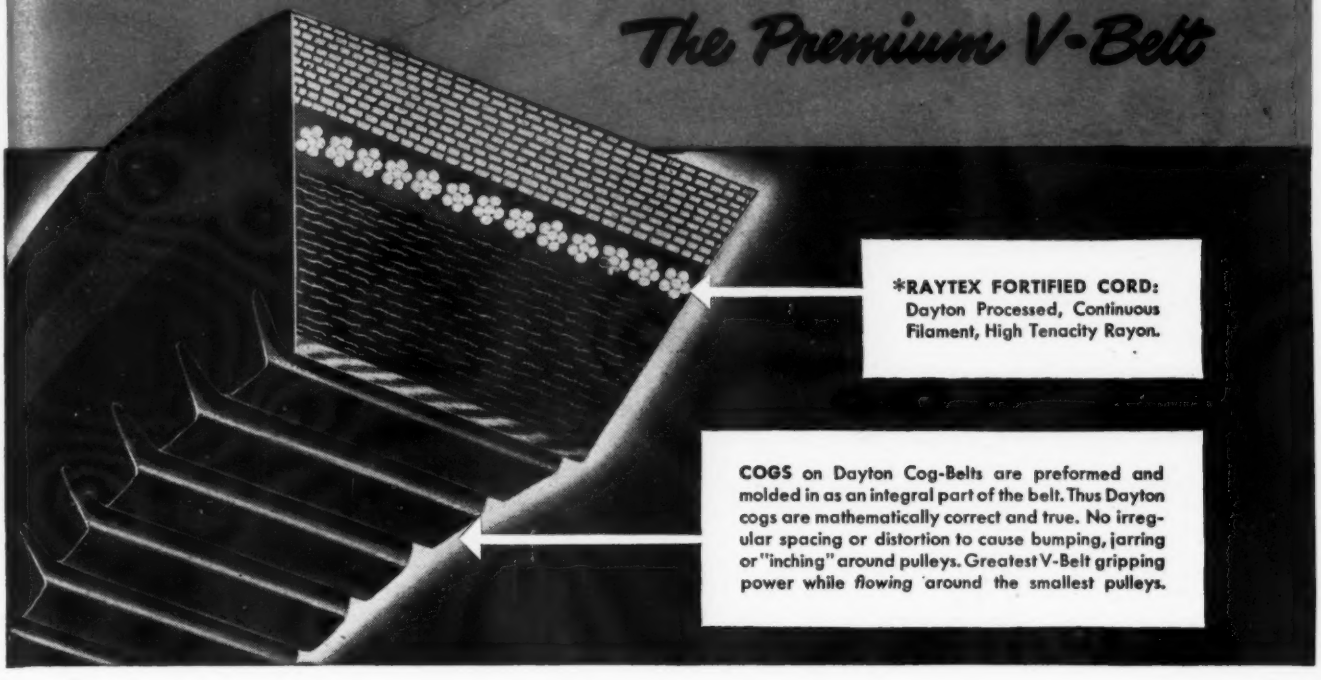
**AMERICAN BLOWER**

DETROIT 32, MICHIGAN

In Canada: CANADIAN SIROCCO CO., LTD., Windsor, Ont.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

# THEY'RE BACK—
# DAYTON COG-BELTS
## *The Premium V-Belt*


*RAYTEX FORTIFIED CORD: Dayton Processed, Continuous Filament, High Tenacity Rayon.
COGS on Dayton Cog-Belts are preformed and molded in as an integral part of the belt. Thus Dayton cogs are mathematically correct and true. No irregular spacing or distortion to cause bumping, jarring or "inching" around pulleys. Greatest V-Belt gripping power while *flowing* around the smallest pulleys.

**Built specifically for use on drives demanding maximum *compactness* with smallest possible pulleys . . . shortest centers**

Yes, they're here . . . the new, premium Dayton Cog-Belts, successor to the famous Dayton Cog-Belts that made power transmission history on the toughest industrial drives in the United States and twenty-seven foreign countries.

Incorporating all the features of the original Dayton Cog-Belt, this new premium V-Belt offers additional advantages gained by the use of war-born materials and developments . . . including *Raytex Fortified Rayon Cords . . . cords that practically eliminate belt stretch, that provide greater flex strength and greatly increased V-Belt life . . . on the smallest pulleys.

The new Dayton Cog-Belt is a premium V-Belt designed and built especially for V-to-V or V-Flat drives that demand:

**SMALLER PULLEYS**—Because of their exclusive preformed and true cog construction with die-cut sides, Dayton Cog-Belts *flow* easily, naturally, around substandard pulleys while providing undistorted maximum contact arc.

**SHORTER CENTERS**—Because smaller pulleys can be used, the distance between the motor and driven machine can also be shortened with proper V-Belt contact arc.

The new Dayton Cog-Belt is now in production in many sizes. It is a premium belt at a premium price, built especially for use on drives where maximum compactness with smallest pulleys and shortest centers is essential. For complete information, call your Dayton V-Belt Distributor.

**DAYTON RUBBER • DAYTON, OHIO**

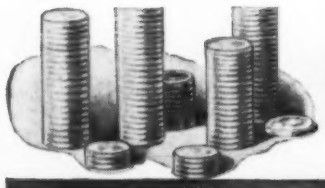
**Branch Offices: Atlanta · Boston · Chicago · Cincinnati Cleveland · Dallas · Dayton · Detroit · Los Angeles Minneapolis · New York · Philadelphia · St. Louis**

*V-BELT BUYERS!* **A leading mill supply house near you stocks Dayton V-Belts . . Look for the name in the yellow pages of your telephone directory**

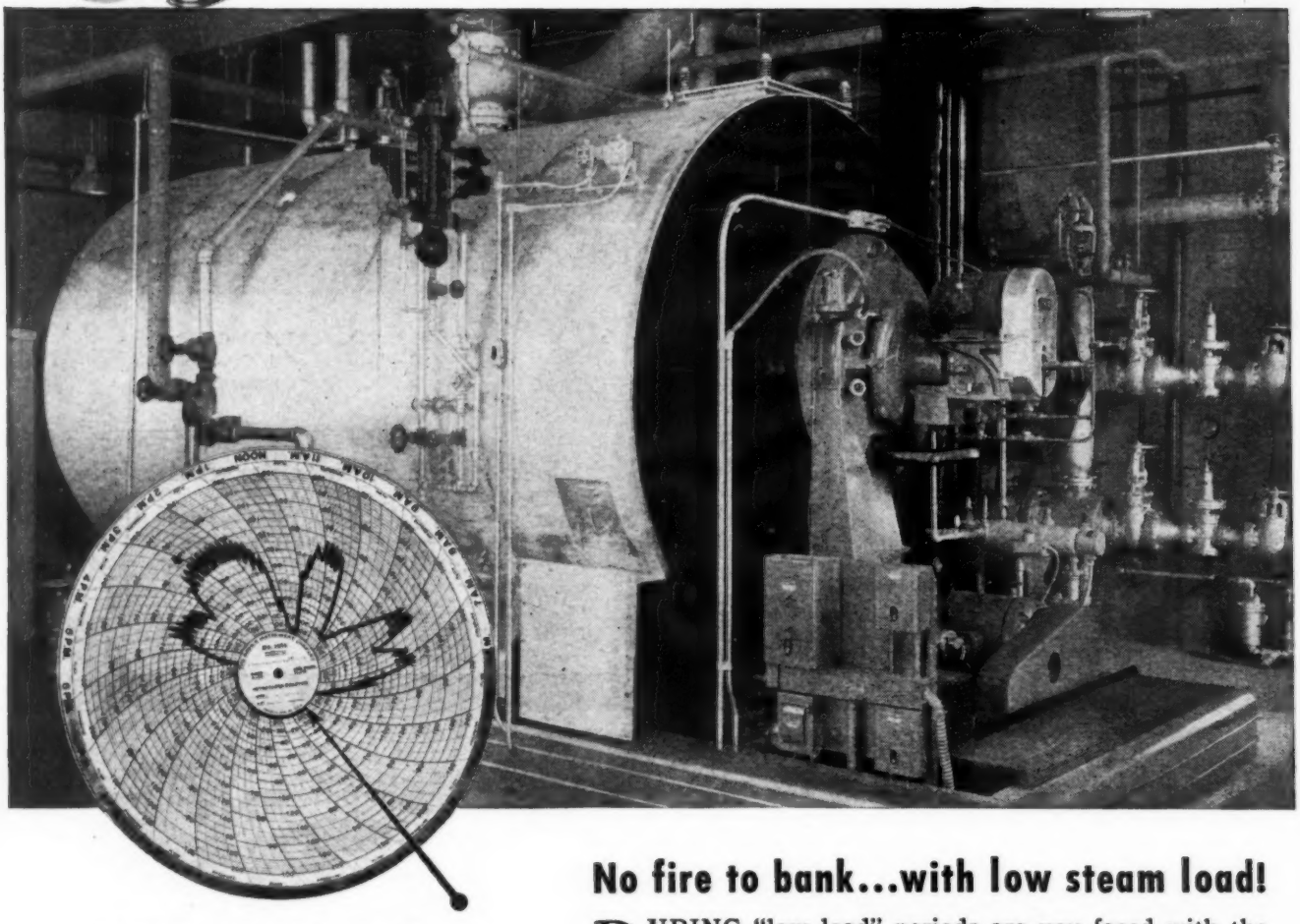
# Dayton Rubber

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS



# SAVE without "BANKING"



Note the "low load period" on this chart — the line for steam demand is at zero — the the fuel used is zero, too!

**Low operating costs;** unsurpassed guarantee: — 80% thermal efficiency from full load down to 30% of its rating; 13½% $CO_2$ gases; stack temperature not to exceed 125° F. above standard steam temperature.

**Quick steaming** — for any emergency or fluctuating loads — through high heat transfer.

**Fast installation.** No special foundation needed. No smokestack required, only simple roof-high vent. Saves space, fits into low head-room locations. Oil-firing provides clean smokeless operation.

**Factory-finished and tested** — a "packaged" unit meeting all code requirements.

**Sizes:** 15 to 500 h.p., pressures from 15 to 200 p.s.i.

*Write for bulletin and complete information.*

## No fire to bank...with low steam load!

DURING "low load" periods are you faced with the problem of maintaining a constant level of heat in your boiler?

The heat losses in a Cleaver-Brooks Steam Generator consist of only radiation losses from the boiler shell itself — design requires no heavy brick settings to cause losses from this source during low load periods — thus eliminating the need for "banking" the fire — and hence no "banking" expense.

The high heat transfer from the 4-pass down draft design produces fast steaming . . . it's just a matter of minutes from a cold start to full pressure.

**Cleaver-Brooks Co., 332 E. Keefe Ave., Milwaukee 12, Wis., U. S. A.**

WRITE on your business letterhead for the Free Steam Cost-Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

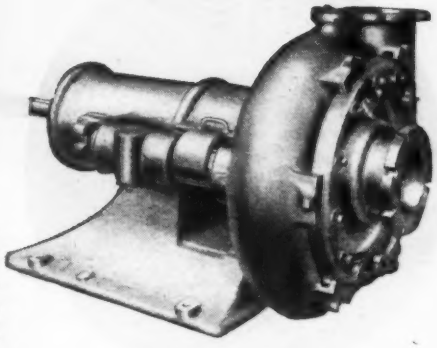
# Cleaver-Brooks

## "Packaged" STEAM GENERATORS

Michigan power plant feeds ash to sluice with water jets.

# PIVOT POINT

## ... AMSCO-NAGLE INDUSTRIAL PUMPS FOR POWER PLANT ASH HANDLING



The best method for clean, fast, economical ash disposal is the wet or sluice method. The best pump for long, trouble-free, low-cost service on this job is an Amsco-Nagle Industrial Pump —, they've been the ideal pivot point in such systems since 1921.

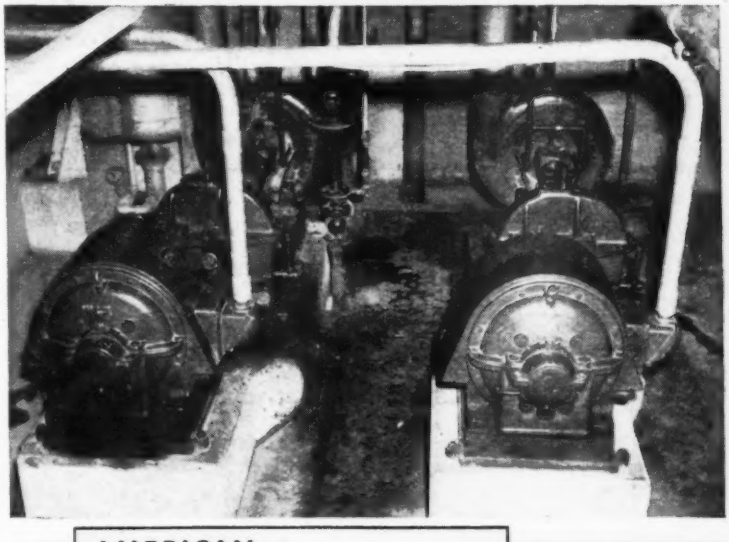
Furnace ash or slag sluiced to sump by high pressure water jets is pumped to convenient point for disposal—eliminates mess, delays, and labor costs of other methods. Photographs show various steps in several power plants—they all use Amsco-Nagle ball-bearing pumps. Only impeller, casing, end plate, and sleeve contact highly abrasive ash . . . and they're manganese steel. The surface of "the toughest steel known" work hardens to resist abrasion while the body metal stays tough to resist stresses. Simplified design for easy maintenance —write for bulletin.

**FURNACE TO PUMP TO DISPOSAL**

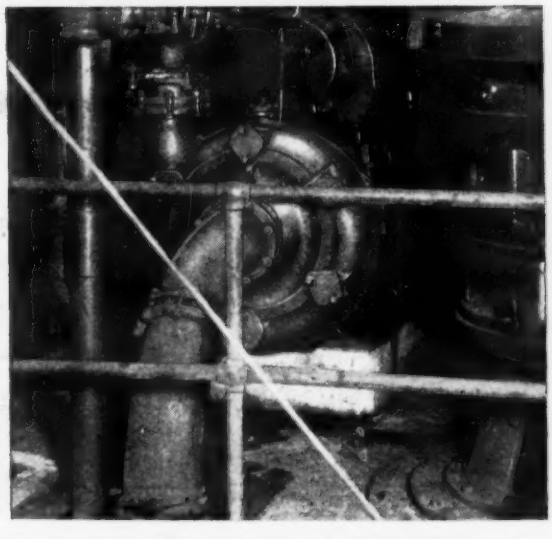
Top: Two Amsco-Nagle pumps discharge ash into disposal area for Ohio power plant.

Bottom: New Jersey plant uses Amsco-Nagle pump to deliver ash to sump for periodic removal by grab-bucket-loaded cars and trucks.

Amsco pumps at a North Carolina power plant. Installation engineered by the Hydro Ash Company, Chicago.



Amsco-Nagle 8", Frame 24 pump with overhead motor and V-belt drive in a mid-western power plant.



AMERICAN Brake Shoe COMPANY

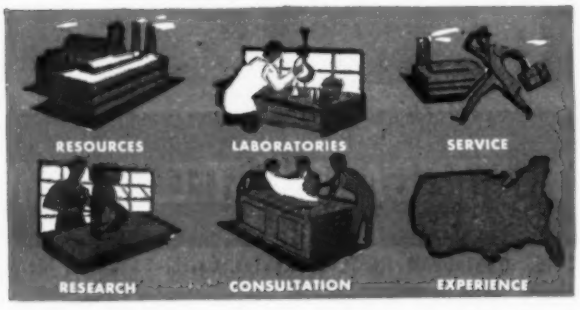
**AMERICAN MANGANESE STEEL DIVISION**
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

# Worth looking into

**LABORATORIES** — *Thoroughly equipped laboratories provide Drew chemists and engineers with the tools required to assure a water conditioning system which will prevent scale, corrosion and carryover, and improve operating conditions.*

When you look into the AMEROID system you'll find it backed by all the factors necessary for a completely successful boiler water treatment . . . a national service organization of trained chemists and engineers; modern analytical laboratories; controlled manufacturing facilities; a progressive research program; and the "know how" that comes only from wide experience. An AMEROID representative will be happy to discuss boiler water conditioning with you at your convenience.




**E. F. DREW & CO., INC.**
15 EAST 26th STREET, NEW YORK 10, N. Y.
COMPLETE AMEROID SERVICE is available in key cities of the United States, Canada, Mexico, Brazil and Puerto Rico.

# Performance Facts

## ABOUT CHALLENGER REPRENE TRANSMISSION BELTING

CURRENT EMPHASIS by industry on the need for new production efficiencies, to combat increased cost factors, has resulted in a sharply increased interest in Republic's popular, heavy-duty transmission belt, Challenger Reprene. The following information on Challenger covers the performance features most frequently asked about:

●

1. **STRENGTH FOR HEAVY, SUSTAINED OR SHOCK LOADS**—Challenger is built in number of plies and weight of fabric according to known load requirements. Exceptional surplus strength is assured by test loads, approximately ten times those of the intended installation, that must be passed before the belts leave the factory.

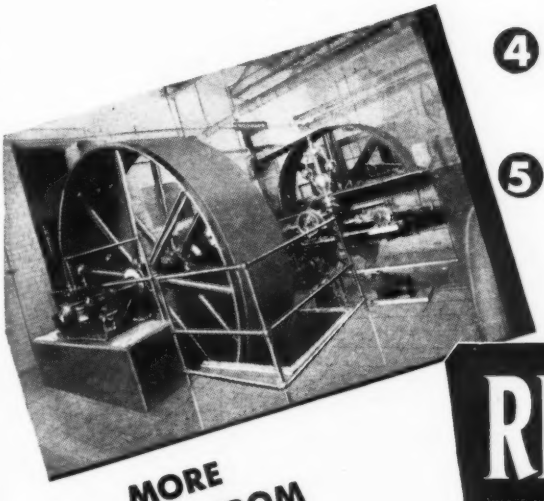
2. **FLEXIBILITY FOR HIGH SPEEDS AND SMALL PULLEYS**—Challenger has a specially developed rubber skim coat between plies that provides unusual flexibility, ply adhesion, and ability to minimize belt-destroying heat build-up.

3. **STRETCHFREE FOR ALL-AROUND EFFICIENCY**—Challenger's flexibility is achieved without sacrifice of the lateral strength required to resist stretch, avoid downtime for shortening and re-fastening.

4. **FRICTION SURFACES FOR MAXIMUM PULLEY TRACTION**—Both of Challenger's outer plies have adhesive friction surfaces, which afford an important degree of extra traction, permit operation from either side with low slack-side tension.

5. **RESISTANCE TO EXTRANEOUS CONDITIONS**—Challenger is impregnated with an especially compounded, oil-resisting rubber and is specifically recommended for installations where excessive oil and grease are present; the belt also is effectively sealed against damaging moisture, fumes, etc.

Your nearby Republic Distributor will make prompt delivery on Challenger and other Republic Rubber products.



**MORE SERVICE FROM RUBBER FOR INDUSTRY**

# REPUBLIC RUBBER

DIVISION

LEE RUBBER & TIRE CORPORATION

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LEE DELUXE TIRES AND TUBES
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# POWER

# *EXIDE*...A NAME THAT STANDS FOR *EXTRA POWER* IN DIESEL CRANKING

Diesel engines start when Exides do the cranking, for Exides have the extra power needed to supply the high cranking speed that Diesel starting demands. And sturdy Exide construction assures a long-life of dependable service with exceptional ease of maintenance.

Exide Batteries for Diesel Engine Cranking are designed specifically for this extremely tough battery job. They are products of Exide engineering and manufacturing skill, plus an experience of many years of close identification with the Diesel engine industry.

Write today for FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

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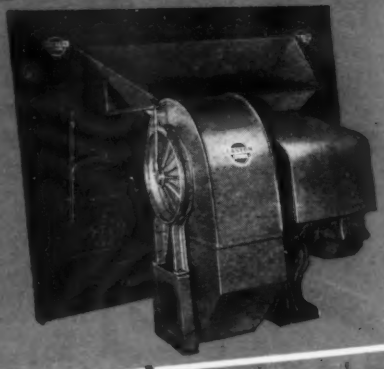
**BATTERIES**

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

# canton stokers

## FOR COMMERCE AND INDUSTRY

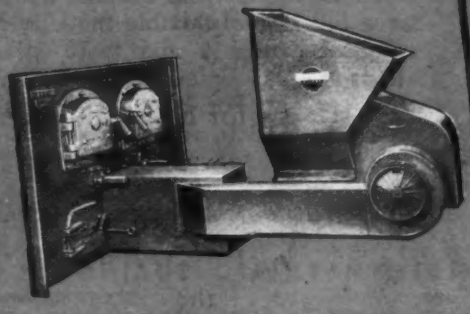


### VULCAN-heavy duty ram type

For use where steam demands vary rapidly and service conditions are severe. Extremely rugged design and ample application of alloys, plus OVER THIRTY-FIVE YEARS experience in building fuel burning equipment, are combined in this efficient, durable machine.

### LO-SET ram feed

Similar to Vulcan Ramfeed in principle and design, but arranged to require less headroom and space. Has same built-in ruggedness and reduces installation costs when applied to existing boilers, and new "Package Unit" boiler designs.



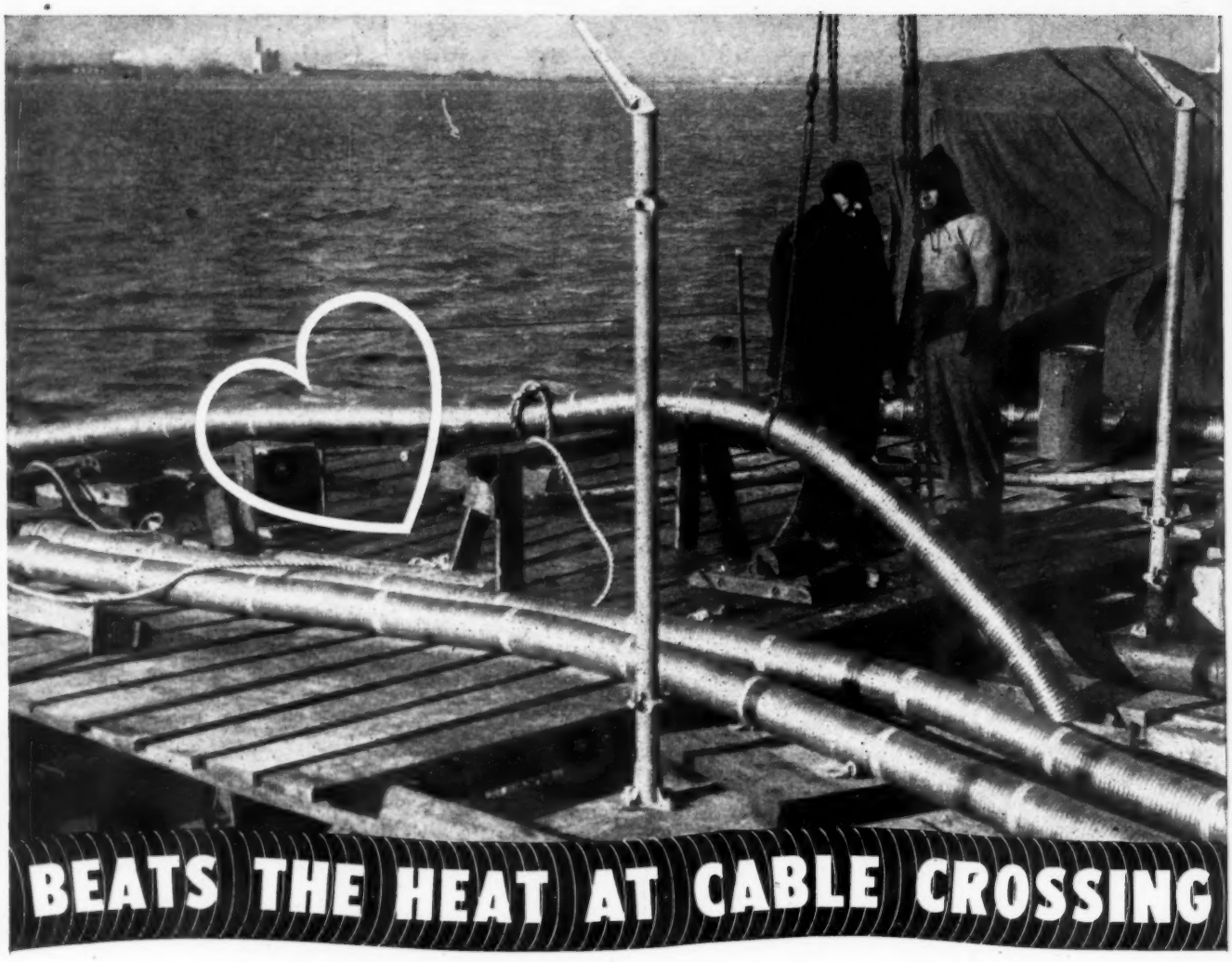
### DURAFLEX — extra-heavy worm feed type

New high standards of sturdiness and durability are incorporated in this worm-feed, side ash dumping model. Industrial tuyere design, zoned air control, sectional alloy feed screw with hardened tip and metered action are some of its more advanced features. Also available in dead plate types.

CANTON STOKERS

**Canton Stoker Corporation**

Canton 1, Ohio



# BEATS THE HEAT AT CABLE CROSSING

**Penflex "Flexineering" helps solve problem of cooling power cables at river crossing**

Cooling and protecting eight under-water power cables as they emerge from the water's edge into the shore terminals was a man-sized problem—until Penflex Engineers, teamed with the construction company, furnished the right answer—flexible cooling jackets.

Long sections of 3½" dia. bronze Penflex hose encase each cable from river's edge to the terminal. These were permanently centered in 6" dia. sections of the same length. After sealing both ends of the units, water was circulated through the 6" sections, forming tight, flexible jackets that keep cables cool and protected. Tailor-made by Penflex, these units were easily installed, saving man-hours, cutting costs.

Streamlined for quick service, Penflex "Flexineering" can help solve numerous flexible tubing problems for machine tool manufacturers . . . construction and road building firms . . . oil refineries . . . shipbuilders . . . power plants . . . and other industries.

Backed by 45 years of engineering know-how, Penflex offers complete service on flexible tubing layout design for your specific needs. Call on Penflex for a full line of flexible metallic hose, tubing, and couplings, from ⅛" dia to 30" dia., in all types, for all uses. Also time-saving automatic barrel fillers, rivet passers. For handy bulletins containing complete information, write today to . . .

**PENFLEX SALES COMPANY**

*Division of*

**PENNSYLVANIA FLEXIBLE METALLIC TUBING COMPANY**

7238 Powers Lane — Philadelphia 42, Pa.

BRANCH SALES OFFICES — Boston • New York • Syracuse • Cleveland • Chicago • Houston • Los Angeles • Washington, D. C.

*Penflex*... HEART OF INDUSTRY'S LIFE LINES

Copyright 1947—Penflex Sales Co.

# SAVE *Installation and Maintenance Costs...*

*with* **PACIFIC TYPE CT VERTICAL PUMPS**

Cooling Tower Water Service Installation with PACIFIC Type CT Vertical Pumps driven by electric motors—Courtesy Phillips Petroleum Company.

Cut Away View PACIFIC Type CT Vertical Pump. Single or Multi-Stage for All Heads. Capacities 1000 to 25,000 G.P.M.

- **PACIFIC CT PUMPS ARE COMPACT**—require *one-third* floor space of horizontal pumps of equal capacity.
- **PACIFIC CT PUMPS ARE EASY TO INSTALL**—do not require expensive foundations or dry pits with sump pumps for drainage.
- **PACIFIC CT PUMPS ARE ALWAYS SUBMERGED**—no priming devices to install and maintain.
- **PACIFIC CT PUMPS ARE ECONOMICAL TO OPERATE**—dynamically balanced impellers prevent destructive vibration. Moderate rotative speeds insure minimum wear—maximum life with sustained efficiency and low maintenance cost.

**PACIFIC**
*Precision Built*
**PUMPS**

**PACIFIC PUMPS, INC.**
HUNTINGTON PARK, CALIFORNIA

*One of the Dresser Industries*

Offices in All Principal Cities—Export Office: 122 E. 42nd Street, New York City

# The dimension that "specs" don't cover

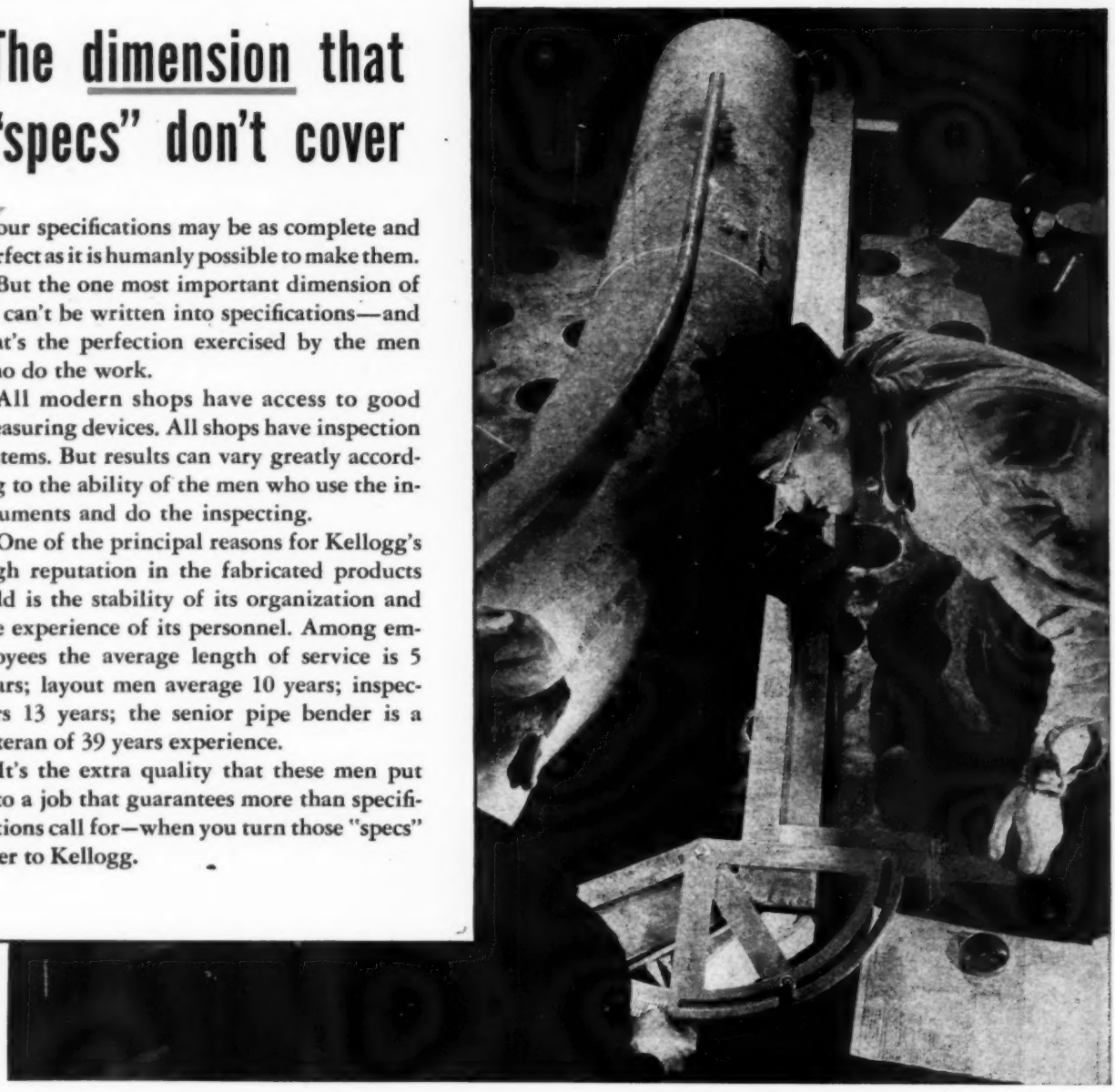
Your specifications may be as complete and perfect as it is humanly possible to make them.

But the one most important dimension of all can't be written into specifications—and that's the perfection exercised by the men who do the work.

All modern shops have access to good measuring devices. All shops have inspection systems. But results can vary greatly according to the ability of the men who use the instruments and do the inspecting.

One of the principal reasons for Kellogg's high reputation in the fabricated products field is the stability of its organization and the experience of its personnel. Among employees the average length of service is 5 years; layout men average 10 years; inspectors 13 years; the senior pipe bender is a veteran of 39 years experience.

It's the extra quality that these men put into a job that guarantees more than specifications call for—when you turn those "specs" over to Kellogg.



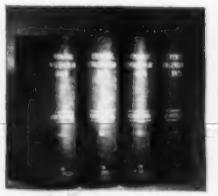
FABRICATED PRODUCTS DIVISION

## THE M. W. KELLOGG COMPANY

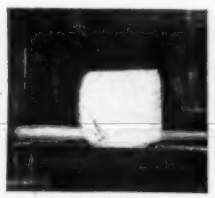
*NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES*
*TULSA • HOUSTON • TORONTO • LONDON • PARIS*

**VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING**
**PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS**

**Metallurgical Research** conducted continually by recognized specialists who have made major contributions in this field.



**Unique Technical Backing** of an extensive organization with an international reputation in both process and fabrication engineering.



**Complete Facilities** for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

**Quality Control** embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

**On-Time Delivery** made possible by a flexible planning group authorized to re-route work to meet promised dates.

**Top Welding Performance** assured by specially designed equipment and exclusive employment of master operators.

**This**

**REVERSIBLE SEAT**

**means**

**DOUBLE VALVE LIFE**

*and 30% to 60% LESS MAINTENANCE EXPENSE*

HOVALCO HOMESTEAD COMBINATION BLOW-OFF VALVES are built to outlast the boiler. Records of 25 to 30 years continuous use in boiler blow-off service are not uncommon. And not only do they have double the life span of ordinary valves, but they cost 30% to 60% less to maintain.

The HOVALCO ANGLE VALVE which takes all of the abuse and regulates the flow, is equipped with a special *reversible,* long wearing, "S" Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

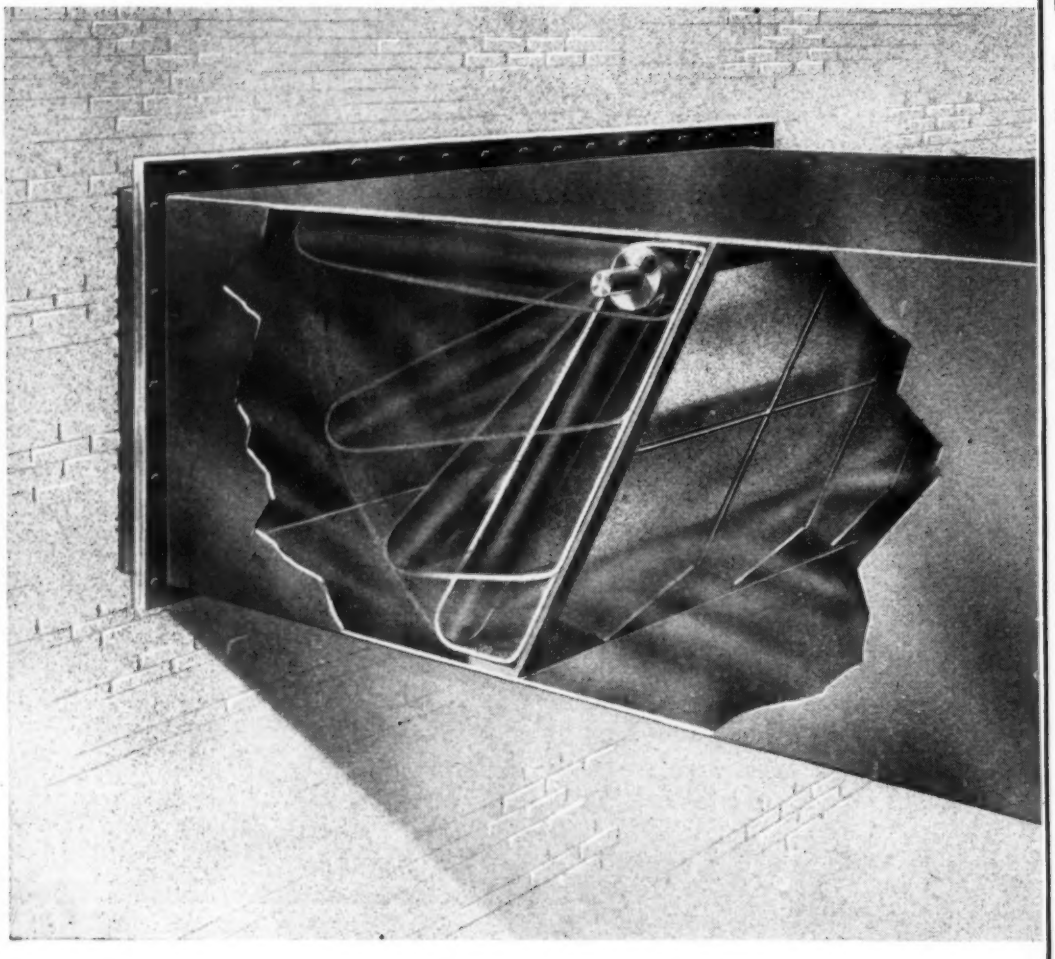
Used in combination with HOMESTEAD LEVER-SEALD or CAM-SEALD QUARTER-TURN VALVES, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Further detailed information and Valve Reference Book No. 38 will be mailed on request.

**HOMESTEAD VALVE MANUFACTURING COMPANY**

**P. O. Box 210** **Coraopolis, Pa.**

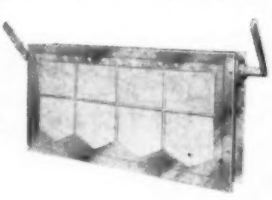
# *Leaf Type* HEACON DAMPERS



## *give more accurate control . . . reduce heat losses due to leakage*

Where two boilers are served by one Stack and only one is normally in operation, type LH, Heacon dampers, have been highly successful as boiler outlet dampers.

On the type LH, the asbestos curtain is held on the damper seals by the draft when closed and is peeled off, illustrated above, as the frame is rotated. Bottom seal is V-ported, permitting improved flow characteristic and more accurate control of the small flows. The following advantages are realized:



1. Leakage from the idle boiler is prevented and the entire stack capacity is available to the active boiler.

2. During nightly and weekend banking periods heat is retained in the boiler that would escape to the stack through a conventional damper.

3. Accurate control of the gas flow from the boiler increases range of output and improves efficiency during operating periods.

Our project engineers will be glad to cooperate with you in making these advantages available to your plant.

**FIELD PROJECT ENGINEERS:**

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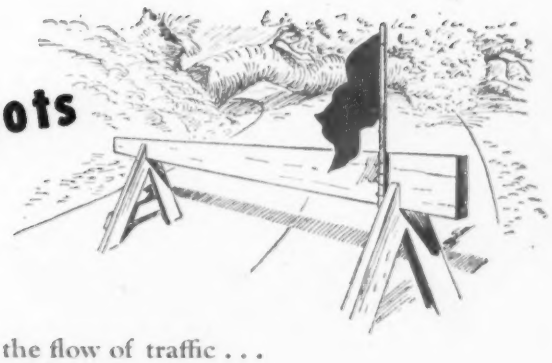
HEACON

# THE THERMIX CORPORATION

**FIRST NATIONAL BANK BLDG.** **GREENWICH, CONNECTICUT**

an K "reason why"

# stands guard at danger spots

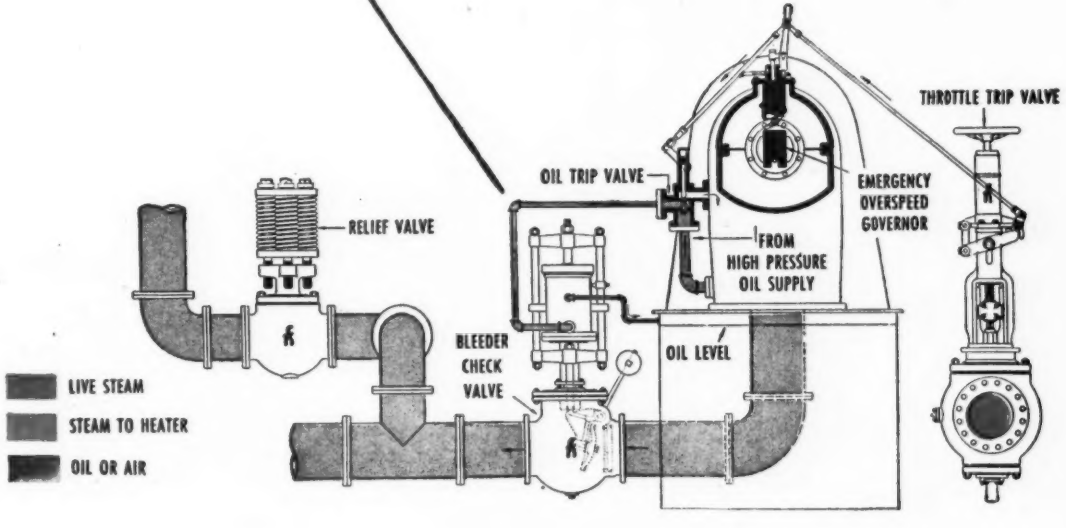


A road-block stops the flow of traffic . . .
Until the danger is past.

An K Turbine Protection System stops flow, too . . .
Stops flow of h. p. steam to turbine . . .
Stops back-flow of l. p. steam . . .
And relieves excess pressure . . .
In extraction line.
It stands guard at danger spots.

Each valve in the system . . .
Throttle, Oil Trip, Bleeder Check, Relief . . .
Performs a particular function . . .
Works with the others . . .
To protect the turbine.

Bulletin 8K contains detailed information . . .
Send for your copy today.

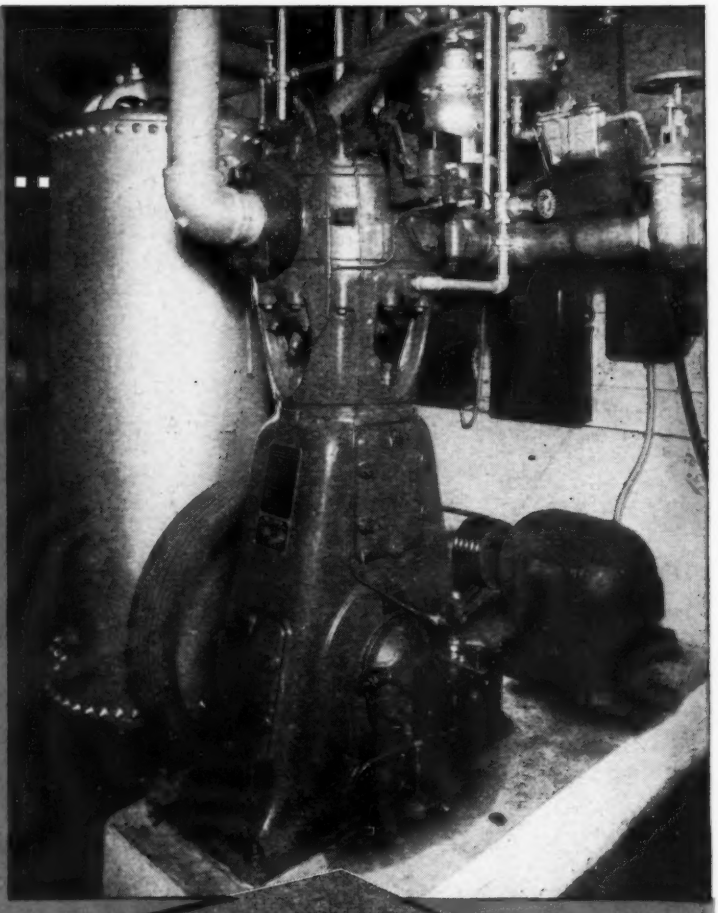



**SCHUTTE & KOERTING COMPANY**
*Manufacturing Engineers*
1150 THOMPSON STREET • PHILADELPHIA 22, PA.

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS AND FLOW INDICATORS RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS

Schutte & Koerting have *always* quoted "firm prices"—a principle in good business, for all business.

HIGHLY COMPACT....
ECONOMICAL
HEAVY DUTY
AIR
COMPRESSORS
that give long trouble-free service



SULLIVAN WG-9

"Always Dependable"
AIR COMPRESSORS
1/4 TO 600 HORSEPOWER

11 SIZES—153 TO 822 C.F.M.
30 TO 150 P.S.I.
SIMPLE BLOCK-TYPE FOUNDATION.
FULL FORCE-FEED LUBRICATION.
ANTI-FRICTION MAIN BEARINGS.
LONG-LIFE "DUAL CUSHION" VALVES.
CYLINDER LINERS REPLACEABLE ON THE JOB.

Consult a Joy Engineer

SULLIVAN DIVISION
JOY MANUFACTURING COMPANY
GENERAL OFFICES: HENRY W. OLIVER BUILDING • PITTSBURGH, PA.

High Temperature

High Pressure

Low Volume

# BJ Hydropress Boiler Feed Pump

**THE HYDROPRESS** is a vertical shaft, double case, double volute, multi-stage centrifugal pump. A Byron Jackson development, it represents the first successful application of the inherently simple and efficient centrifugal pump to high pressure, low volume pumping. It is ideally suited to high pressure, high temperature boiler feed service (except for very large installations, for which the BJ Horizontal Boiler Feed Pump is recommended).

**THE HYDROPRESS** has many advantages: high efficiency at low capacity and high pressure; minimum floor space required; needs only a simple foundation; no vibration or objectionable noise; smooth, continuous, non-pulsating flow; easily dismantled and reassembled; only one stuffing-box, which is under suction pressure; running clearances maintained, regardless of temperature; vertical pump shaft insures minimum wear.

**Byron Jackson Co.**

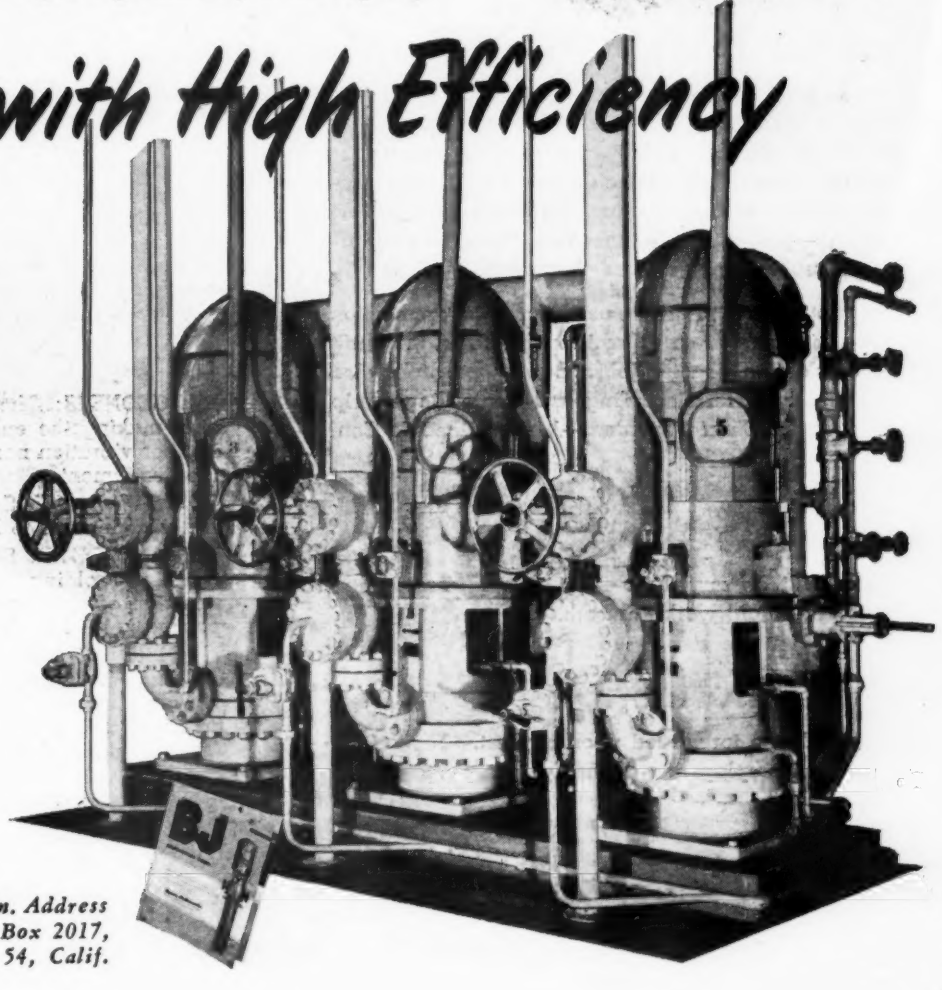
LOS ANGELES 54, CALIFORNIA

*Offices in Principal Cities*

## Pumping with High Efficiency

**CAPACITY RANGE:**
TO 150,000 LBS. PER HR.

**PRESSURE RANGE:**
TO 3,000 PSI




### *300,000 lbs. per hour*

**A FEW SQ. FT. OF FLOOR SPACE**

BJ Hydropress Pumps require very little floor space. The three shown here occupy but a few square feet, yet they deliver 300,000 pounds per hour of boiler feed water (each pump delivers 100,000 pounds per hour at 850 psi). The 150 hp, 2300 volt motors operate at 3550 rpm.

*Get this new Hydropress Bulletin. Address Dept. 170, Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles 54, Calif.*

## Personal History

I come from a large family of problem solvers—the ElectroniK Family. It is traditional in our family to be quick, accurate and sensitive to changing conditions. I am considered not only well balanced, but "Continuous Balance" is my forte—no inching—no nudging—just a smooth, effortless, instantaneous follow-through on temperature changes.

The picture that I have used for this application shows me arrayed as a Precision Indicator, the outfit I use for central reading jobs. But my wardrobe also contains styles for Recording and Controlling—Strip and Circular Chart Recorders—Air and Electric Controllers.

## Personal Preferences

None—Will go anywhere—Hot—Cold—Temperate. Day work—night work—or both.

## Further Information

Will gladly be forwarded upon request. Thousands of satisfied employers will testify to my versatility.

## Brains

CALIBRATED ACCURACY: Normally within ± 1/5% of scale span.

SENSITIVITY: Normally 1/32 of 1% of scale span.

ELECTRONIC:"Continuous Balance" SYSTEM: Eliminates manual balancing. Has no galvanometer. Balancing motor and mechanism move only during a change in the measured variable, reducing wear of parts to an absolute minimum. Entire balancing operation is non-cyclic—responds instantly to a change in measured e.m.f.

## Brawn

RUGGEDNESS: The few mechanical parts are oversize, making the entire assembly extremely rugged. Neither vibration nor position affects the operation of the instrument.

POSITIVE DRIVE: Scale and slide wire contactor directly connected to balancing motor at all times.

THERMOCOUPLE SWITCHES: Built-in push-button type—self-holding but automatically released upon selection of another point. Number of thermocouple points: 6, 12, 18, 24, 30, 36 or 48.

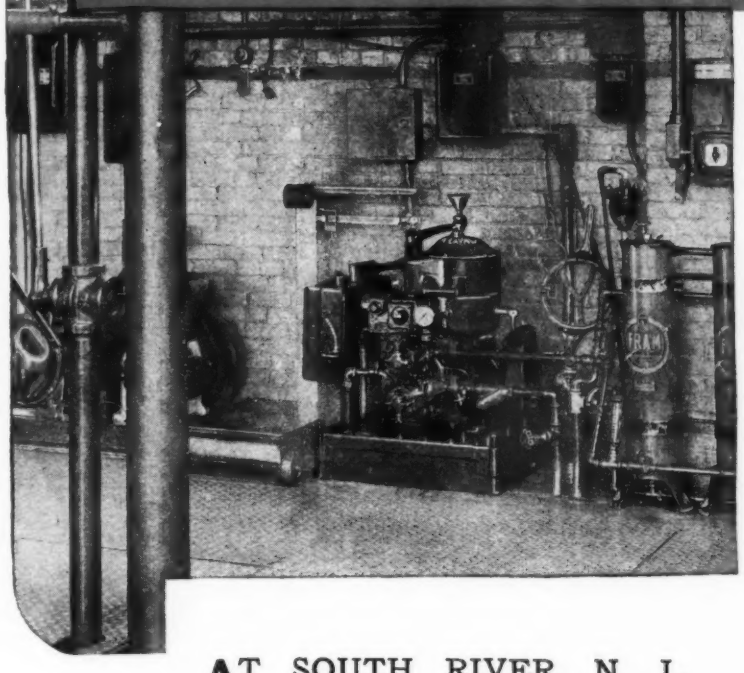
THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada; London, England; Amsterdam, Holland; Brussels, Belgium; Stockholm, Sweden.

BROWN *Electronik* POTENTIOMETERS

# CRANK CASE STILL CLEAN

AFTER

# 11,000 HOURS!



AT SOUTH RIVER, N. J., Municipal Plant the lubricating oil used in the 1500 hp. Fulton Diesel engine was kept clean for approximately two years by means of a De Laval "Puri-Filter". At the end of 11,000 hours, when a regular crank case inspection was made, the South River operators found that the De Laval "Puri-Filter" combination unit had so thoroughly cleaned the oil of dirt, abrasives and carbon that the crank case was still clean—almost completely free of carbon.

The De Laval "Puri-Filter" is a combination of a De Laval "Uni-Matic" Oil Purifier and Fram "Filcron" Filters. By centrifugal force the Purifier continuously removes water and separates out dirt; colloidal carbon is removed by positive filtration. The oil remains so clean that after 11,000 hours of use at South River a newspaper could still be read through a test tube full of the oil!

The complete South River story will be sent on request.

**DE LAVAL**
**OIL PURIFIERS**
*FOR DIESEL LUBRICATING OIL*

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
PETERBOROUGH
QUEBEC MONTREAL WINNIPEG VANCOUVER

# THE BATTLE AGAINST HIGH COSTS

# STARTS IN YOUR BOILER ROOM...

• In a general survey of your operations with a view to reducing costs, the logical place to begin is in the boiler room. Here you will find immediate opportunity to make money through the installation of CASH STANDARD Automatic Combustion Control.

When this installation is made you save fuel and have more steam with less fuel and all this with your present boiler.

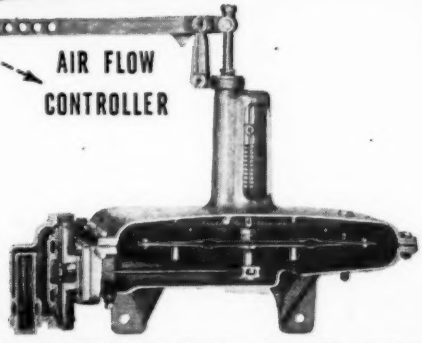
The reason for this is that with CASH STANDARD Automatic Combustion Control you maintain correct fuel feed — the correct fuel-air ratio, and constant overfire draft.

Read Bulletin No. 300. It gives interesting details on the operation of these units. Also tells how CASH STANDARD Units can be combined to make a dependable, cost-saving Automatic Combustion Control System that meets all conditions and that works on any boiler or stoker with any kind of fuel.

## CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

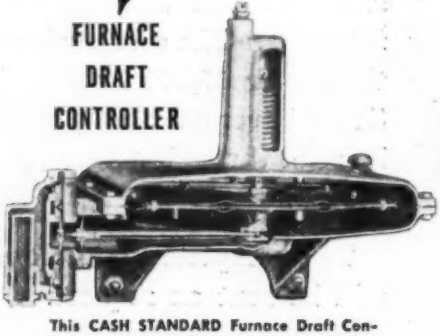
## MAKE IMMEDIATE AND CONTINUOUS SAVINGS WITH THIS EQUIPMENT

AIR FLOW CONTROLLER

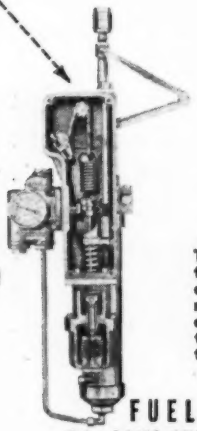


This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

FURNACE DRAFT CONTROLLER



This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



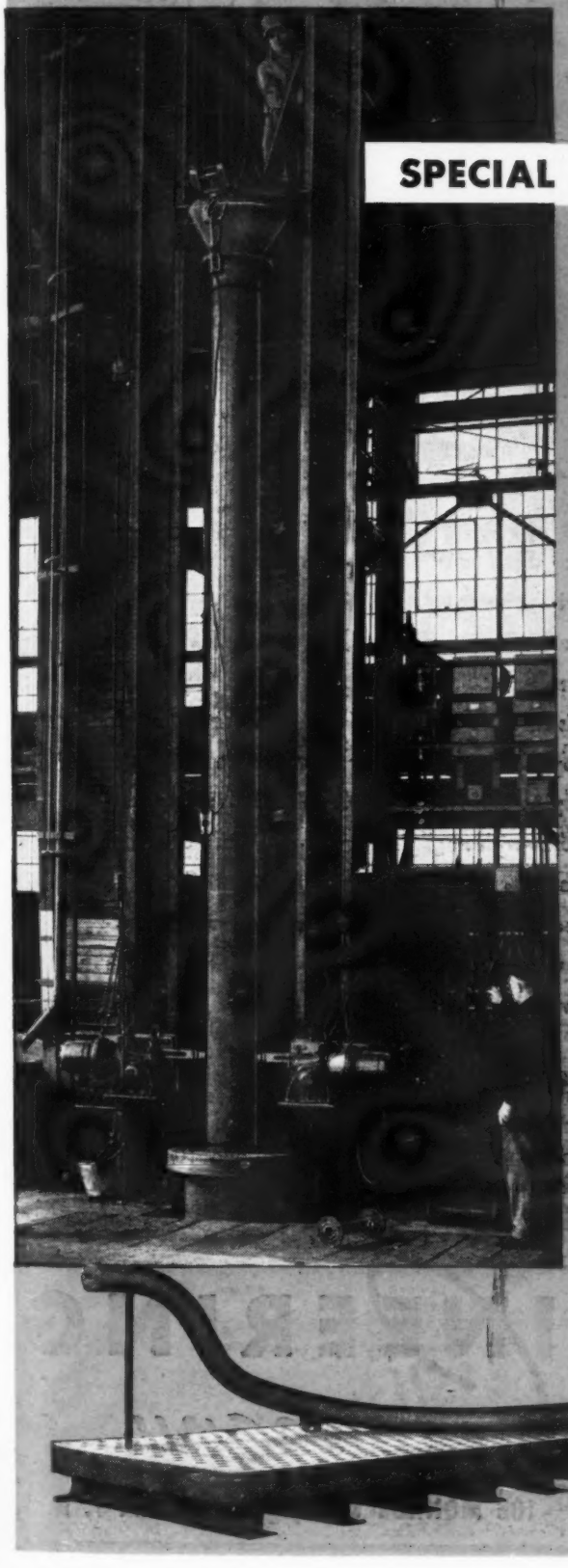
FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving.

## A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

# MODERN PRESSURE PIPING REQUIRES SPECIALIZED SHOP EQUIPMENT AND PERSONNEL



## SPECIAL SAND PACKING EQUIPMENT

## ...One of Many Important Factors in Producing BETTER PIPE BENDS

Correct sand packing is an essential to pipe bends that must meet modern standards. Proper sand packing prevents flattening of the pipe wall as the pipe is bent. Heat retention of the sand is utilized extensively by the expert bender to attain the advantages of slow cooling.

Qualified pipe fabricators are equipped with special machines for proper sand packing. In addition they have special bending tables, and other specialized equipment to aid the bender.

Expert benders must be developed by many years of experience in the shop . . . for pipe bending within engineering tolerances is a difficult art which few learn well.

High quality bends are extremely important in successful pipe fabrication. Such bends cannot be produced by trial and error methods. They need experts using the specialized equipment and working under the best conditions provided only by the qualified pipe fabricator.

THE PIPE FABRICATION INSTITUTE

PFI THE PIPE FABRICATION INSTITUTE

*Devoted to the Technical and Economic Problems in Piping*

1109 CLARK BUILDING PITTSBURGH, PA.

Write for Technical Bulletin describing pressure piping fabrication

3825-4

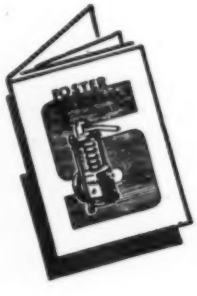
# 3,000 psi 1,000°F

## THIS NEW SAFETY VALVE SAVES MONEY ON EVERY POP !

The Foster Type 38-SV Super-Jet Safety Valve for pressures up to 3000 pounds and temperatures up to1000° F.

Because it reseats as close as 1% below popping pressure, the Foster 38-SV Super-Jet Safety Valve saves steam—saves *money*—on every pop. This new valve blows off only enough steam for safety . . . then reseats positively, without pounding or chatter.

But steam economy is only one advantage of this new safety valve. It is virtually unaffected by changes in temperature—once set under operating conditions, its popping point is constant. It gives full rated nozzle capacity at popping pressure—with negligible accumulation. Full opening is practically instantaneous—reseating is positive, without flutter or rebound even after sustained or successive lifts. And blowdown is adjustable from 8% down to 1% without chatter or pounding because steam cannot accumulate above valve disc.



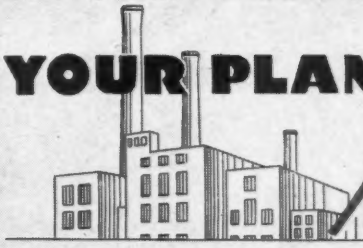
The Foster 38-SV Safety Valve was especially designed for pressures up to 3000 pounds and temperatures up to 1000° F. In fact, they are now being tested at temperatures considerably above 1000° F. Investigate its many features and advantages by writing for Bulletin 25 today.

# FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK 1, N. J.

# ARE YOUR PLANT OPERATIONS



# Restricted

## by the Refractories you use now?

PRESENT SAFE OPERATING TEMPERATURE

Whereas the temperatures at which your boiler furnace is being operated may be sufficiently high, it may also be true that lining life and operating efficiency are being curtailed by inadequate refractories. Power plant operation often calls for a special refractory . . . such as Norton CRYSTOLON Brick. Made of silicon carbide plus a minimum of refractory bond these bricks are highly refractory, chemically stable, physically strong and abrasion-resistant. They are not affected by the erosive action of molten slag and clinkers will never penetrate their dense surface. For efficient boiler furnace performance demand a special refractory. When you want a special refractory, always ask for CRYSTOLON Brick.

**NORTON COMPANY** **WORCESTER 6, MASS.**

# SKILLED ENGINEERING

**The difficulties encountered in the fabrication and erection of Central Station and Industrial Piping are many and varied.**

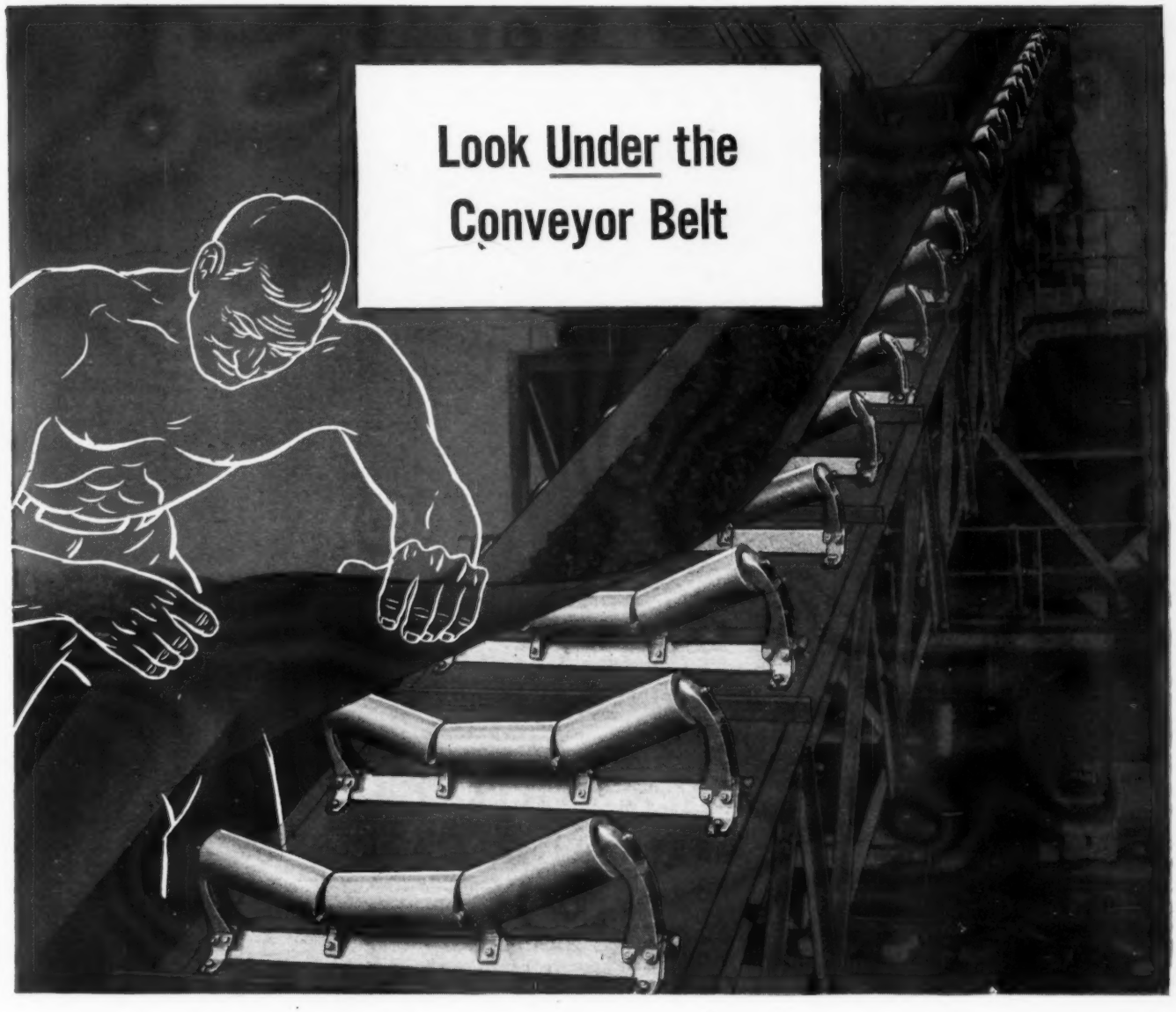
**The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your assurance of economy and safety of operation.**

***Consult Navco for your next Piping Job.***

## NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI




## A belt conveyor is as efficient as the carriers

What do you expect of a belt conveyor system? Low handling cost over the long term, isn't it? Then by all means, take a good look at what you put UNDER the belt —at the carriers.

For carriers take a terrific beating, and for a successful, economical system, choose carriers that can stand a beating. Choose carriers like the S-A "Simplex" shown above. Steel and malleable iron construction assures ability to withstand heavy loads. Rollers turn on Timken tapered roller bearings. These bearings are housed in an inner tube within the roller, with die-cast labyrinth seals, the best known method for protection against dust and moisture. In addition, each outer bracket provides a hood which fits closely against the end of the roller and sheds any loose material away from the bearing.

"Simplex" carriers are only one of numerous carriers designed and built by Stephens-Adamson for every type of belt conveyor service. Ask an S-A engineer—or write direct —for full information on types best suited to your needs.

**STEPHENS-ADAMSON MFG. CO.**

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. • BELLEVILLE, ONT.

*Designers and Manufacturers of All Types of*
BULK MATERIAL HANDLING EQUIPMENT

# "WE CUT STEAM COSTS 48%
## —and paid for conversion in 10 months"*

## YOU SAVE 3 WAYS WITH ENTERPRISE *Oil Burners*
## —IN EFFICIENCY, CLEANLINESS AND ECONOMY

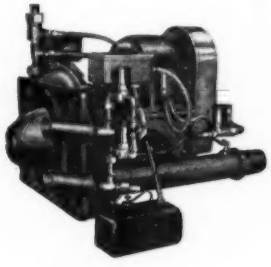
Cutting steam costs by almost half seems unbelievable. Yet this is but one of innumerable conversion jobs from old-fashioned, uneconomical combustion systems to Enterprise Oil Burners that proves the rule of exceptional savings in fuel costs, minimum upkeep, and continuous efficiency under the most exacting requirements.

A leader in the field, Enterprise manufactures rotary oil burners in a wide range of heavy-duty models—with a flexibility of application to meet the needs of modern building and industry in all its branches. Enterprise burners are furnished in Manual, Semi-Automatic and Fully-Automatic Models in combination with modulating fire control or any desired special combinations.

Whether you are considering combustion equipment for a new installation or as a replacement of obsolete units, plan to investigate Enterprise Burners. A call to your nearest Enterprise distributor, or a letter to the Combustion Equipment Division in San Francisco, will bring a prompt answer to questions regarding your particular problems.

* *From a statement by the Director of* THE DOCTORS HOSPITAL *in Seattle.*

Installed by Superior Engineering Co. of Seattle, two of these Model H2P Semi-Automatic Enterprise Oil Burners operate 24 hours a day producing 4,000 pounds of steam per hour for The Doctors Hospital heating, sterilizing and laundry needs.



IN EVERY INDUSTRY ENTERPRISE AROUND THE WORLD

**ENTERPRISE**
***Oil Burners*** **DISTRIBUTORS IN PRINCIPAL CITIES**

COMBUSTION EQUIPMENT DIVISION OF
ENTERPRISE ENGINE & FOUNDRY CO.
18TH AND FLORIDA STREETS, SAN FRANCISCO 10, CALIFORNIA

DIESEL ENGINES • PROCESS MACHINERY • OIL BURNERS • HEAVY MACHINERY

# FORGED STEEL FITTINGS ARE CHEAPER TO USE ON ALL PIPING JOBS

Forging compacts the metal, eliminating all chances of concealed defects. There is more steel in a forged fitting, more strength, more wear, more toughness, than in any other make of fitting. These advantages add years of life to the use of the fitting and eliminate costly breakdown and maintenance problems, therefore making a forged steel fitting the cheapest to use for all piping jobs.

All W-S fittings are machined from solid drop forgings and have uniform thickness of walls throughout, assuring a high factor of safety.

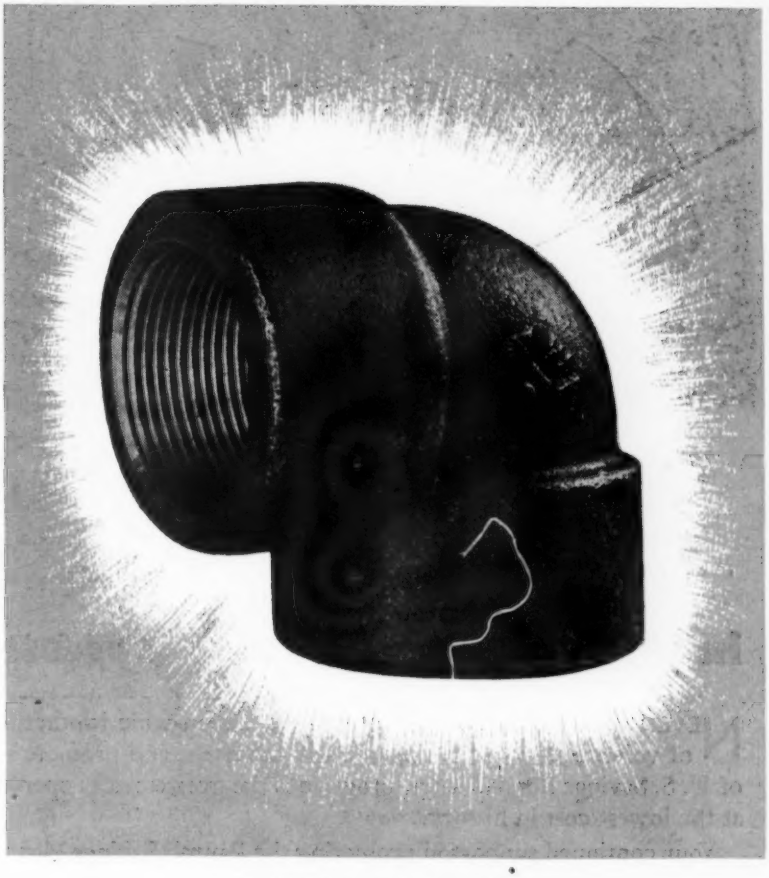
Because of the compact grain structure of forged steel fittings they are more resistant to corrosion and erosion.

W-S screw end fittings are accurately threaded to close tolerance for perfect fit and have long bands for better wrench grip. Available in 2000, 3000 and 6000# classes.

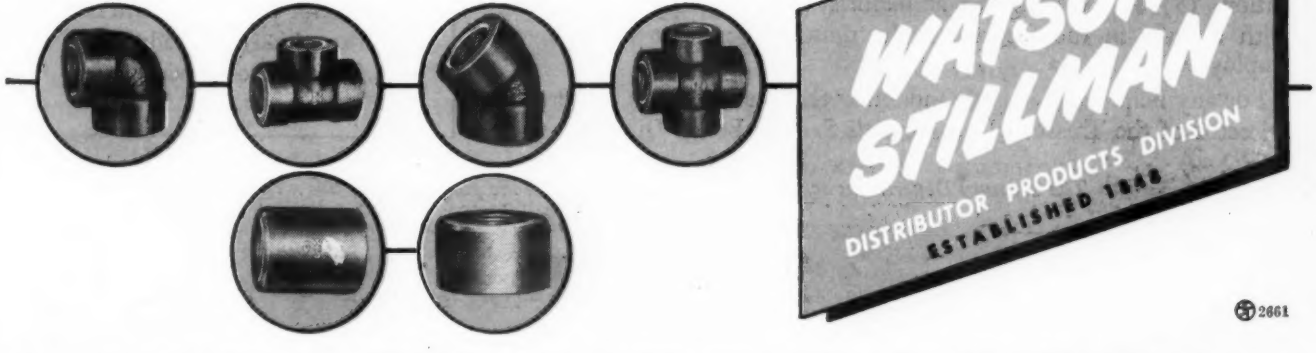
W-S socket welding fittings are easily slipped over pipe ends and are ready for welding. Deep sockets support pipe, eliminating special fixtures or tack welding. Position of weld eliminates icicles inside the pipe, thereby assuring smooth flow. Available for use with Schedules 40, 80 and 160 pipe and double extra strong pipe.

All fittings can be had in carbon steel, carbon molybdenum steel, and various types of stainless steel.

Remember—if it is forged steel you save money in any type of service. Look for the W-S mark and be sure.



***Sold Through Leading Industrial Distributors***




2661

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

# *ARE YOU STILL* AN ACTIVE PARTNER...

## in this "7½ billion-a-year" success?

NEVER was there a partnership like the nation-wide brotherhood of volunteers who have helped sell, advertise, and promote sales of U. S. Savings Bonds! Their program is the greatest sales operation at the lowest cost in history.

Your continued support in promoting the Payroll Savings Plan will help "America's partnership" this year to repeat or surpass last year's four-star performance, in which sales of Savings Bonds were 7½ billion dollars—*exceeding redemptions by far more than a billion!*

So keep up the splendid work—keep on telling and selling your employees the advantages of Payroll Savings: (1) ease; (2) regularity; (3) safety of investment; (4) security for the individual and the nation; (5) $4 for every $3 at maturity! And, remember, people with a stake in the future are the most stable, most productive employees.

For any help you need in conducting the Plan, call on your State Director of the Treasury Department's Savings Bonds Division.

### *New Savings Bonds Plan won't affect the P.S.P.*

THE Treasury Department and the banks of America are making it possible for farmers, doctors, and other self-employed people to participate in "automatic" Bond buying by special arrangement with their banks. This extension of the Savings Bonds program is not a partial payment plan and is intended *only* for people who are not in a position to take advantage of the Payroll Savings Plan.

*The Treasury Department acknowledges with appreciation the publication of this message by*

**POWER**

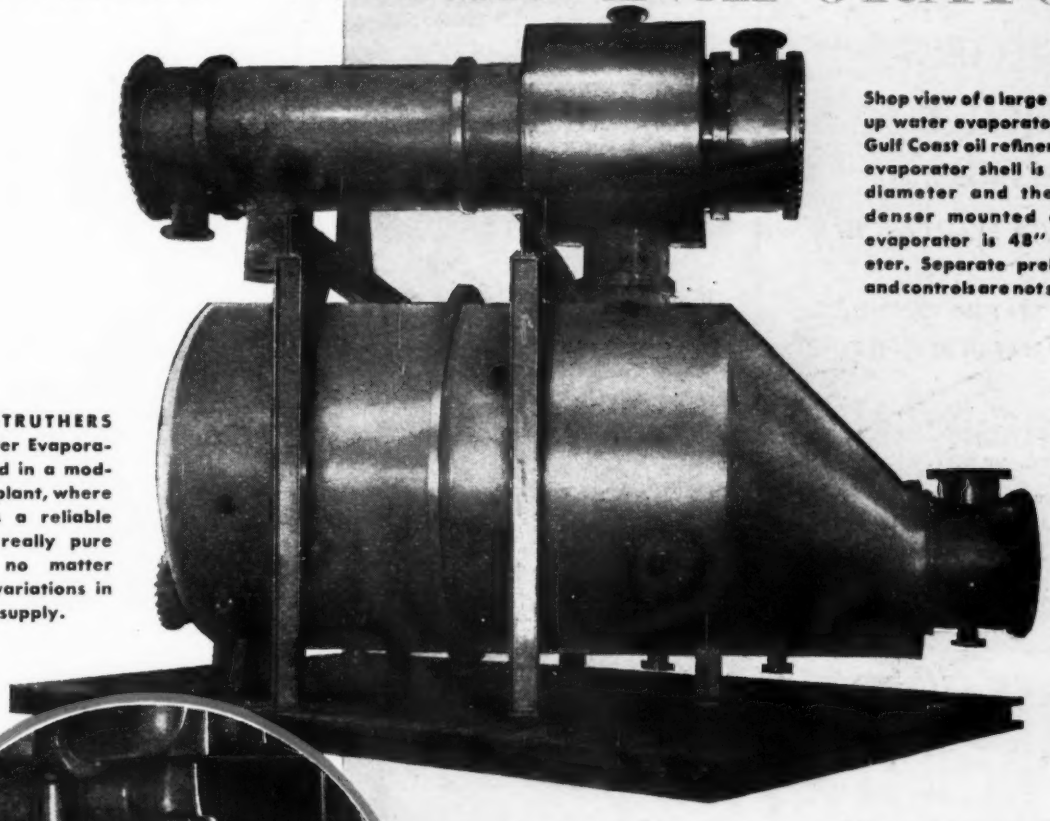
*This is an official U.S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.*

## When you have difficult HEAT BALANCE and WATER SUPPLY PROBLEMS

**SW STRUTHERS WELLS**

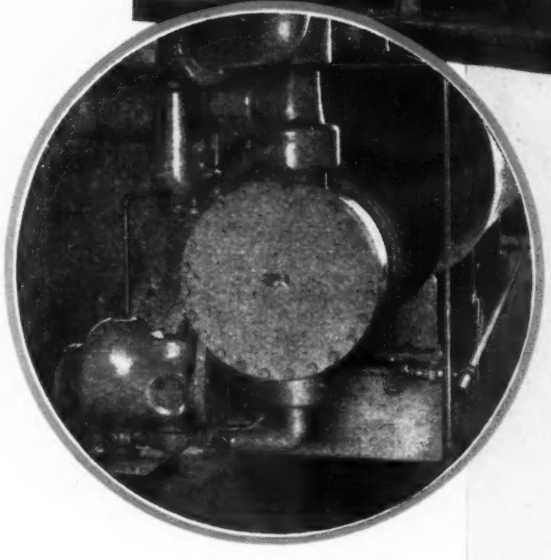
*is a dependable source for*

# MODERN WATER EVAPORATORS



Shop view of a large make-up water evaporator for a Gulf Coast oil refinery. The evaporator shell is 10'0" diameter and the condenser mounted above evaporator is 48" diameter. Separate preheater and controls are not shown.

Typical STRUTHERS WELLS Water Evaporator installed in a modern power plant, where it provides a reliable supply of really pure make-up, no matter what the variations in raw water supply.



In modern high-pressure power plants, pure make-up water is essential, regardless of the raw water source available.

With years of experience in all types of evaporation problems, and having successfully handled many types of water, STRUTHERS WELLS can supply an evaporator to fit into any heat balance and water supply problem. Provisions for thermal descaling and for assurance of highest vapor purity are included without any complicated construction.

Also available for power plant service are closed Feedwater Heaters, featuring the "Boltless Head" high pressure closure; blowdown exchangers, oil coolers, and other similar items of heat transfer equipment.

Bulletins descriptive of power plant equipment are available on request.

**STRUTHERS WELLS CORP.**

*PROCESS EQUIPMENT DIVISION*

WARREN, PENNA.

PLANTS AT WARREN, PENNA. AND TITUSVILLE, PENNA.

# DESIGNERS WANTED

## MECHANICAL
## STRUCTURAL
## ELECTRICAL
## ELECTRICAL DIAGRAM

Familiar With

POWER PLANT WORK

**WRITE STATING EXPERIENCE OR APPLY IN PERSON TO**

## CONSOLIDATED EDISON
CO. OF N. Y. INC.

*"a good place to work"*

**130 East 15th St., N. Y. 3, N. Y.**

**(ROOM 224)**



# FOR SALE
## Seamless Steel Pipe

(Specification ASTM A-106 — Grade B)

| Total Feet Available | O.D. | Average Wall | Price per 100 Feet |
|---|---|---|---|
| 915 | 5 5/16" | .950" | $300.00 |
| 2585 | 5 5/16" | .789" | 258.00 |
| 2475 | 6 5/8" | .996" | 384.00 |
| 1470 | 8 5/8" | 1.237" | 658.00 |
| 780 | 10 3/4" | 1.443" | 966.00 |

**Average Lengths Available**

Item #1–18 to 24 ft. Item #3–18 to 22 ft.
Item #2–17 to 24 ft. Item #4–13 to 24 ft.
Item #5–20 to 24 ft.

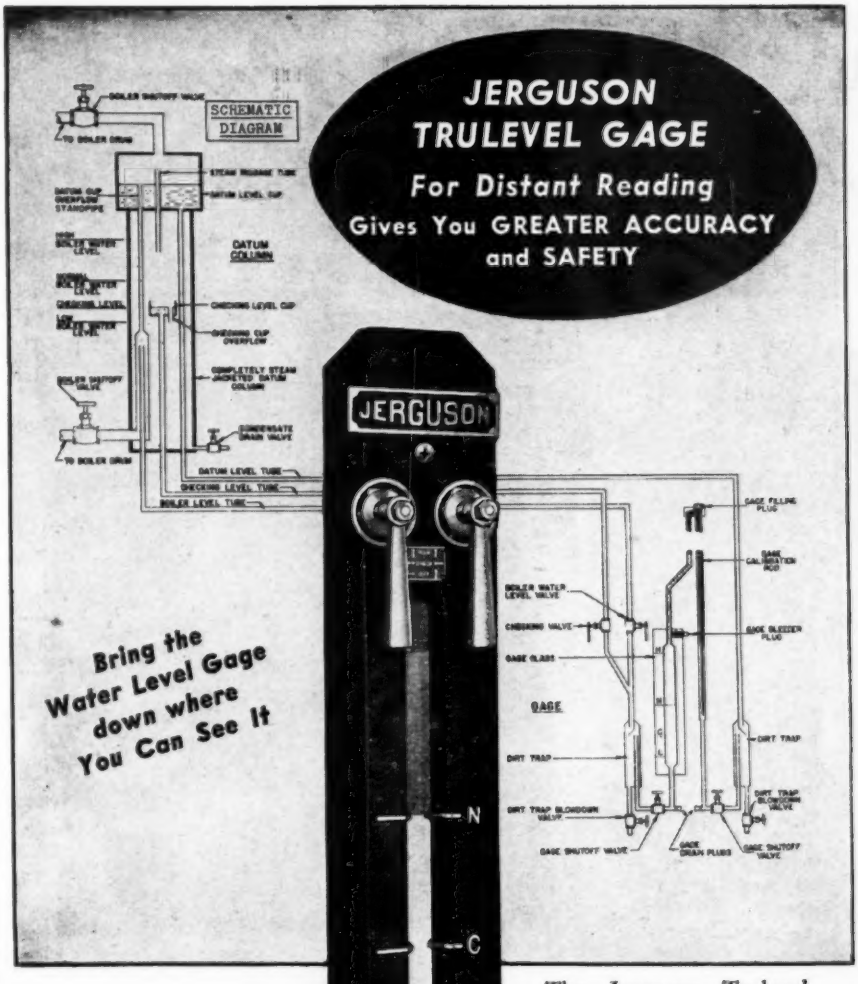
**TERMS:**
½% 10 Days—Net 30
F.O.B. Cudahy, Wis.

$25.00 charge on lots of less than 250 feet on an individual item.

*All offerings subject to prior sale.*

## LADISH CO.
**CUDAHY • WIS.**
(MILWAUKEE SUBURB)






*Jerguson Trulevel Gage may be either wall or panel mounted.*

The Jerguson Trulevel Gage gives you greater accuracy and safety because it is precision engineered and built with these three important features:

**1.** Built-in checking feature for quick, easy checking of accuracy and operation. **2.** Easy-to-read water level indication. Water level appears in natural position, contrasted with brilliant blue of manometric fluid above. Back-illuminated. **3.** Positive reading through new datum column, which is fully steam jacketed and duplicates the temperature and specific gravity conditions which exist in the boiler drum.

Stainless steel construction for long, dependable service. Black crackle finish aluminum cover.

Three standard sizes: #1, for pressures up to 600 lbs. #2, for pressures up to 900 lbs. #3, for pressures over 900 lbs.

***Write for Engineering Data Unit***

## JERGUSON
**GAGE & VALVE COMPANY**

**100 Fellsway • Somerville 45, Mass.**

***Representatives in Major Cities . . . Phone Listed Under JERGUSON***

# NORDBERG *Again Sets the Pace*

## *with a successful supercharged*

# DUAFUEL DIESEL

● Six cylinder, 1220 horsepower, four-cycle, supercharged Nordberg Duafuel Diesel engine installed at the Lehigh Portland Cement Company, Iola, Kansas.

**Will operate on GAS FUEL**

**OR**

**OIL FUEL**

**OR**

**Any proportion of either fuel**

HERE is another Diesel achievement by Nordberg. This Nordberg Duafuel installation is among the first and the larger supercharged, automatic gas and oil burning Diesels in commercial service . . . By means of a single control wheel, the engine can be set to operate on gas, on oil or any desired combination of each fuel without shutting down. Should there be a failure of supply of one fuel, the engine automatically shifts over to the other fuel. With this engine it is always possible to operate on the fuel which can be burned most advantageously . . . If gas is available for your operations, investigate the merits of Nordberg Duafuel power. These engines in the four-cycle type are available in sizes up to 1630 horsepower. Larger gas burning Diesels in the two-cycle type are available in sizes up to 8500 horsepower.

**NORDBERG MFG. CO.**
**MILWAUKEE 7, WISCONSIN**

NORDBERG MACHINERY

# NORDBERG

## DIESEL ENGINES

NORDBERG MACHINERY

GENERAL CONTROLS . . .
THE ACKNOWLEDGED STANDARD IN AUTOMATIC PRESSURE, TEMPERATURE AND FLOW CONTROL UNITS

*Here are a few* of an outstanding line of controls for Industrial, Commercial and Domestic applications.

★ALL-GAS CONTROLS
★AIRCRAFT CONTROLS, ELECTRIC
★AUTOMATIC SAFETY PILOTS
★GAS REGULATORS
★LOW WATER CONTROLS
★GOVERNOR TYPE VALVES
★HI-LOW OFF VALVES
★INDUSTRIAL VALVES
★LOW PRESSURE GAS VALVES
★MOTOR OPERATED VALVES
★MAGNETIC GAS VALVES
★PILOT BURNERS
★PILOT GENERATORS
★REFRIGERATION VALVES
★SOLENOID VALVES
★STRAINERS—RELAYS
★100% SHUT-OFF VALVES
★THERMOSTATIC CONTROLS
★TRANSFORMERS—SWITCHES
★THERMOVALVES

*Controls for air, water, steam, natural, manufactured and liquefied petroleum gases, light and heavy oils, etc., refrigerants such as freon, methyl chloride, sulphur dioxide and ammonia.*
*A.C. or D.C., normally closed or open types. High and low pressures and temperatures.* PROVED AND IMPROVED PERFORMANCE IS PROOF THAT YOU CAN'T BUY BETTER CONTROLS.

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1 CALIF
*Manufacturers of Automatic Pressure, Temperature and Flow Controls*
FACTORY BRANCHES AND DISTRIBUTORS IN PRINCIPAL CITIES



*Eliminate* RUST AND CORROSION....

This *Free* Booklet Tells How

- Apply directly over any rusted surface.
- Simply wire brush to remove loose paint, scale and dirt.
- Excellent coverage—gallons of economy.

Rust-Oleum is the most effective rust preventive for railroad maintenance... No other protective coating equals it in safe-guarding metal. Rust-Oleum penetrates rust—incorporates it within the film—and forms a tough, elastic coating that contracts and expands with the metal, and will not crack, blister or peel off. *Greater coverage and longer life mean extra low cost.*

**Write for Catalog**
Specify the rusted item for test and the conditions that cause the rust.

RUST-OLEUM CORPORATION
2421 Oakton Street, Evanston, Illinois



# If You Employ PRESSURE You Need SAFETY HEADS!

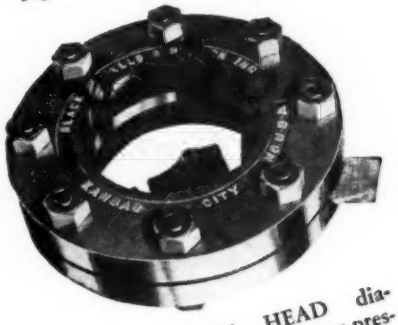
A SAFETY HEAD is your Sentinel of Safety against over-pressure, for use wherever you have a liquid or a gas under pressure . . . 5 up to 25,000 psi. Black, Sivalls & Bryson SAFETY HEADS are simple, positive pressure "fuses" that burst in tension at pre-determined pressures and temperatures. Every SAFETY HEAD is tailor made to fit the specific job for which it is designed. Get more relief capacity per dollar cost. SAFETY HEADS can readily and easily be designed for your needs just as they have for thousands of other plants.

Write today for complete details, latest catalog. Address the Special Products Division, Executive Offices, Black, Sivalls & Bryson, Power and Light Building, Kansas City 6, Missouri.

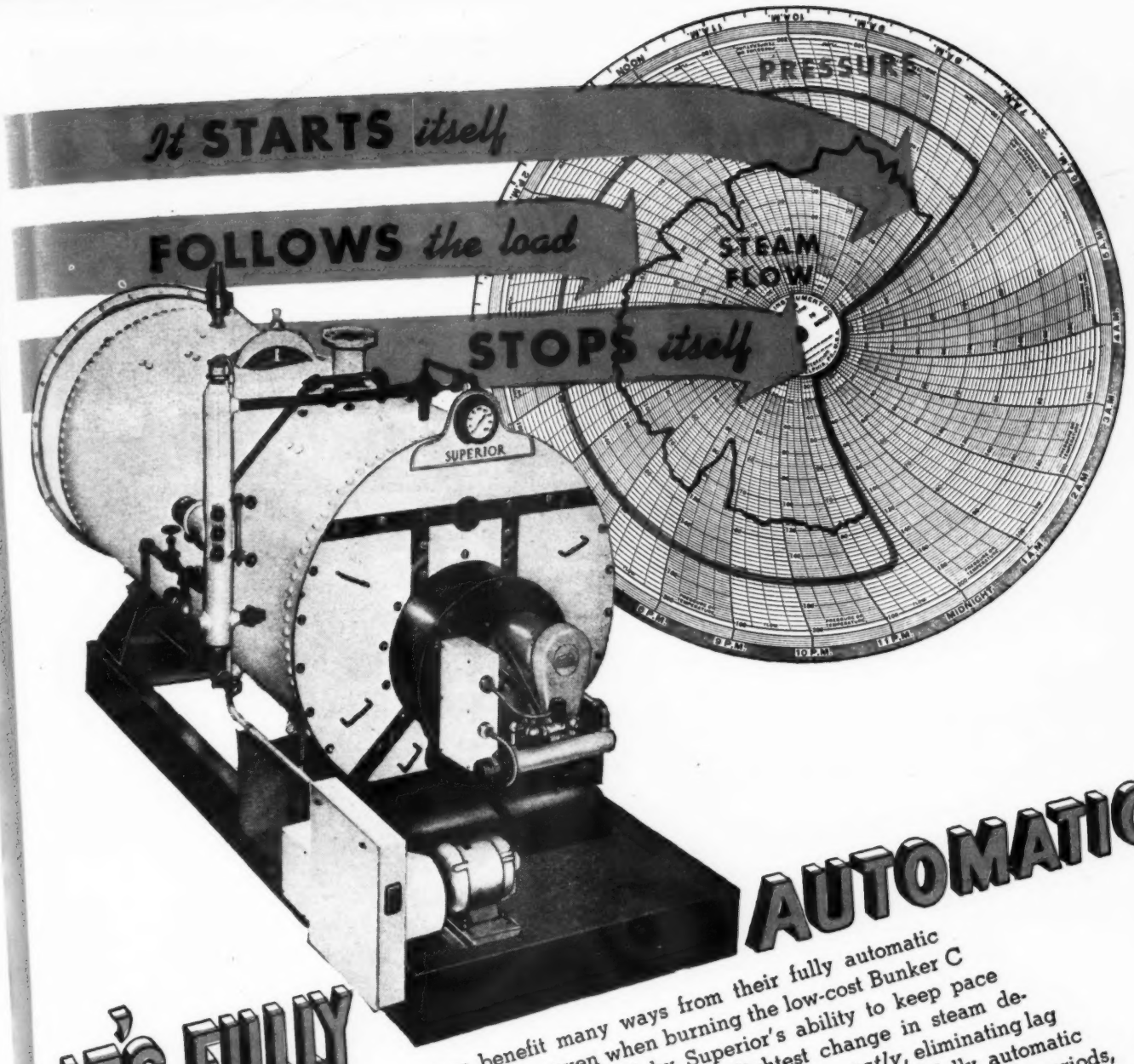
*Foreign Inquiries Invited*

BLACK, SIVALLS & BRYSON, INC.
KANSAS CITY — EFFICIENCY RELIABILITY — OKLAHOMA CITY
Cable address: Black, Kansas City, U.S.A.

● B S & B SAFETY HEAD. Shows preformed spheroidal rupture diaphragm.




● SAFETY HEAD diaphragm burst by over-pressure. Note full discharge opening. (19)




# IT'S FULLY AUTOMATIC

Owners of Superior Steam Generators benefit many ways from their fully automatic operation. And they *are* completely automatic, even when burning the low-cost Bunker C fuel oils. • Most important are the savings effected by Superior's ability to keep pace with fluctuating loads. Its sensitive controls respond to the slightest change in steam demand; automatically increasing or decreasing the fire to follow the load *exactly*, eliminating lag and over-ride, generating steam as needed, without waste. • In addition, fully automatic operation eliminates the need of maintaining a low fire throughout long inoperative periods, and reduces human supervision to a minimum. It provides a complete shut-down when the load stops . . . whether that be in the middle, or at the end of the day's operations. Then, at your option, it will remain inoperative until automatic controls start it in time for the next day's work; or it will maintain a head of steam between periods of load demand.

We'd like to acquaint you with *all* the features of Superior Steam Generators. They have all the advantages, and will do everything which *any* packaged steam plant can do, plus points which are exclusively their own. Write today for Catalog 101.

**Superior Combustion Industries, inc.**

*Emmaus, Pa.*

*Here's the answer to*

NATIONAL AIROIL FUEL OIL - GAS BURNERS

# COAL SHORTAGES

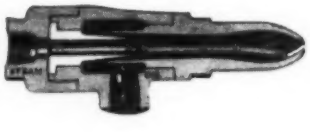
**Our Oil Burners are extensively used as supplementary firing equipment in existing stoker fired boilers**

When coal deliveries fail or stokers are inadequate to meet peak steam demands, the installation of a supplementary fuel system assures the desired capacity. In some cases, up to 75% of the peak load has been easily carried on the supplementary fuel (depending in proportion on geographic factors and relative costs of the several fuels) without clogging of boiler passes or objectionable smoke and cinders. Such installations become dual fuel systems . . . inexpensive insurance against plant shut-down. Can your plant afford to be without this insurance?

Types "SA" and "SAR" Oil Burners are ideal for installation as supplementary fuel systems. Type "SA" is adaptable to all forms of industrial heating, power or process furnaces; completely atomizes and thoroughly burns the lowest and cheapest grades of fuel oil, tar, and waste oils; requires only low oil pressure and temperature, and the internal atomizing feature uses steam for atomization. Type "SAR" (where steam or gas is available for atomization) safely and efficiently burns residuums obtained from process.

We have been *specialists* in the burning of liquid and gaseous fuels for 35 years. Your inquiries, accompanied by full plant data are invited . . . write now for Bulletin #21.

TYPE "SA"

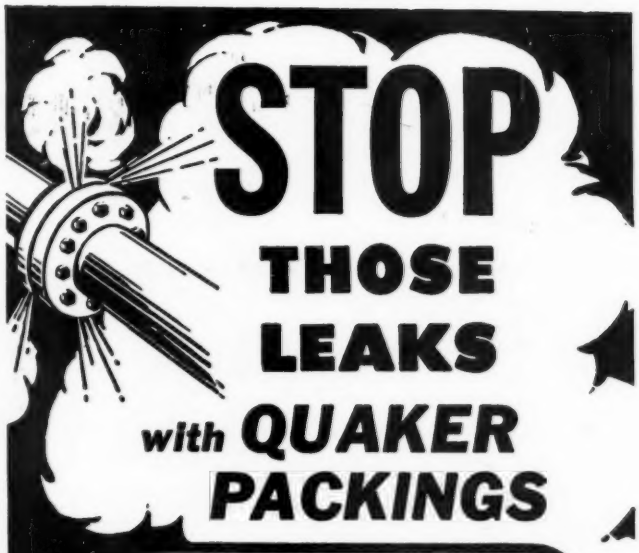


TYPE "SAR"

NATIONAL AIROIL BURNER CO., INC.

Main Offices & Factory: 1280 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Texas Office: 2nd National Bank Bldg., Houston





# STOP THOSE LEAKS with QUAKER PACKINGS

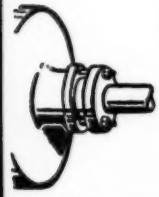
## VALVOLITE
**Valve Stem Packing**

. . . carefully twisted and lubricated, seals tightly. Stays pliable under extreme heat and pressure. Won't score stems.

## EBONITE
**Sheet Packing**

. . . keeps high-pressure joints and flanges tight, leak proof. Will not harden or melt, expands evenly. Ideal for superheated steam, gas, oil, acids.

## P. P. P.
**Piston Rod Packing**



Pressure seals itself with sliding wedge action. Assures minimum friction, long service under high pressure. Call your Quaker Distributor for quick service.

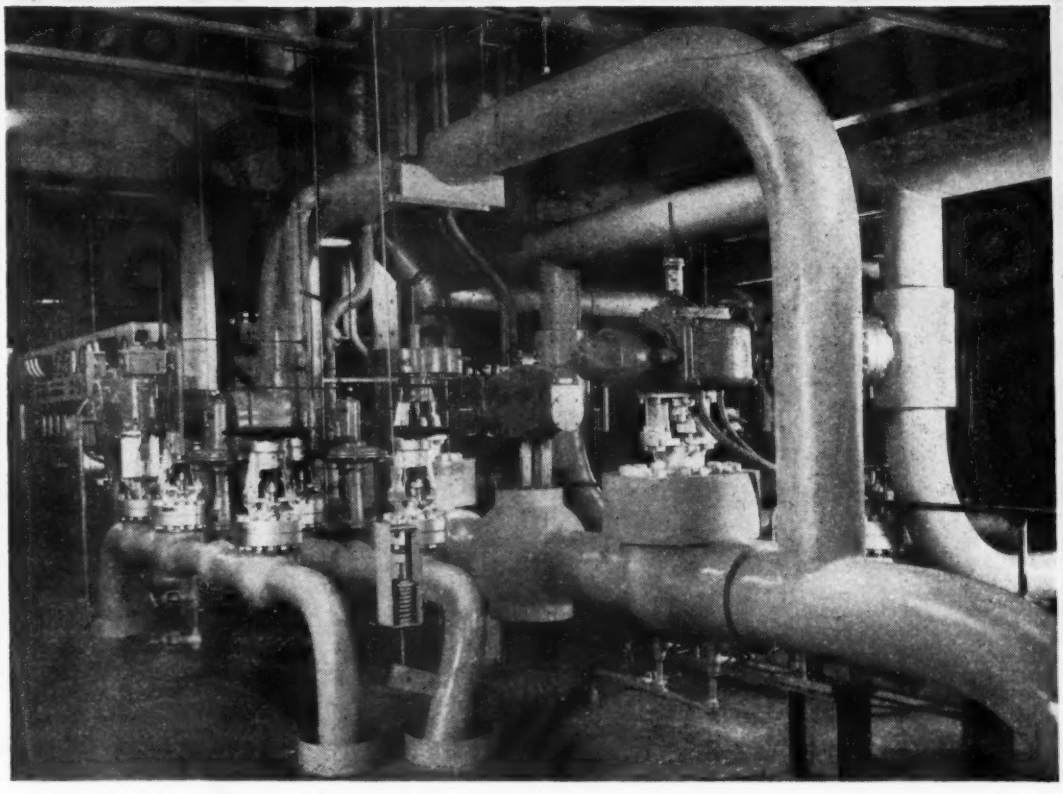
*"If there's a way to get it done... Quaker will do it".*

QUAKER RUBBER CORPORATION

PHILADELPHIA 24, PA.

NEW YORK 7 • CLEVELAND 15 • CHICAGO 16 • HOUSTON 1
Western Territory
QUAKER PACIFIC RUBBER CO. • San Francisco 5 • Los Angeles 21

# *Complete* PIPING SYSTEMS



## A JOB FOR AN EXPERT

Give us your blueprints—and quit worrying. Prefabrication by P. P. & E. will give you a complete piping installation that begins with the selection of the proper materials for the conditions to be met, and ends only when your power plant is completely erected and delivering power.

From spray pond to turbine, the piping should be fabricated and erected for a specific job. You will have such an installation only through expert shop fabrication, by a modern plant with every facility for assembling materials that are needed; completely erected by skilled craftsmen for every specialized task; with the knowledge accumulated through 44 years' experience.

There's a Pittsburgh Piping installation near you. Contact our nearest representative or write us for further information.

**Pittsburgh Piping**
**AND EQUIPMENT COMPANY**
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
315 West 9th Street, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta

# Built to stand up under 24 hour a day service

● Type H Heavy Duty Worm Gear Reducers driving 54-in. and 48-in. tumbling mills in steel foundry. Ratio 11-1/3 to 1 and 7-3/4 to 1.

TODAY every phase of production work calls for drives that will stay on the job. Jones Worm Gear Speed Reducers have been built for long, trouble-free service. And the records established by these speed reducers in 24 hour a day service show that they have the ruggedness and stamina for which all Jones Transmission Products are known.

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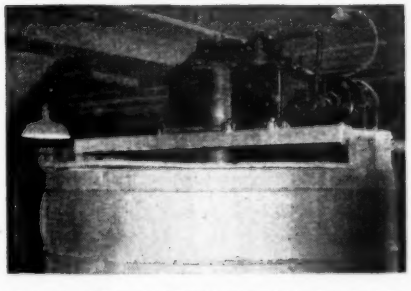

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**Smith & Oby Co., Heating Contractors, Cleveland, Ohio**

IN the piping systems of the new 7-story addition to the Cleveland Clinic, we are using arc welding for pipe joints and for making brackets and hanger frames to simplify installation.

Fig. 1 shows the welding of risers which run about 120 feet from the basement to the top floor. At left and center are 5-inch feed and return pipes for air conditioning chilled water. At right is a 4″ steam line. These horizontal welds in vertical pipe are made as shown in Fig. 2, using ⅛″ "Fleetweld 5" Electrode for first pass and 3/16″ for subsequent passes.

*Fig. 2.*

At each floor level the risers are held by the bracket frame shown in Fig. 3. It is made from 2″ x 2″ angle, corners formed by coping out one flange, bending and welding in one pass. Holding rings are cut from pipe and fillet welded to the frame. The frame is welded to the building structure as shown. Wedges hold the pipe until insulation is applied.

The basement support for these risers is shown in Fig. 4. The supports are made from the same diameter pipe, flame-cut to fit and welded in three

*Fig. 1. Making finish pass on vertical pipe.*

passes. A concrete column supports the three runs.

The frame—shown in Fig. 5—to hold copper water lines is made of ½″ x 2½″ bars, 28″ and 6¾″ in length. The ends are scarfed 45° and joined at corners with welds inside and outside. The plumbers' sleeves for different size pipes are cut from pipe and welded to the rectangle with continuous fillets. This frame fits over an opening in the concrete floor as shown.

We used "Fleetweld 5" electrode for all welding and a Lincoln "Shield-Arc

*Fig. 4. Basement support for risers.*

SAE" 300-amp. motor-driven welder, shown in Fig. 6.

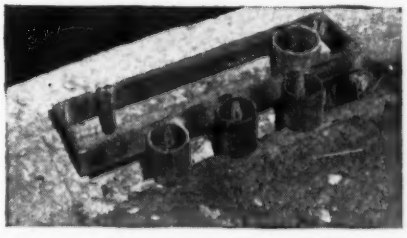
*Fig. 5. Another frame for holding water lines at each floor level.*

Specifications and procedures for "Fleetweld 5" and all other Lincoln electrodes are given in the Weldirectory. A free copy may be obtained by writing The Lincoln Electric Company, Dept. 461, Cleveland 1, Ohio.

*Fig. 3. Bracket which holds risers in alignment is welded to I-beam joist.*

*Fig. 6. Adjusting controls of "Shield-Arc" motor-driven welder. Running gear is handy on construction jobs.*

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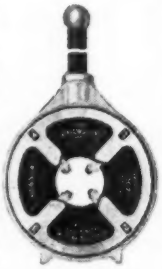

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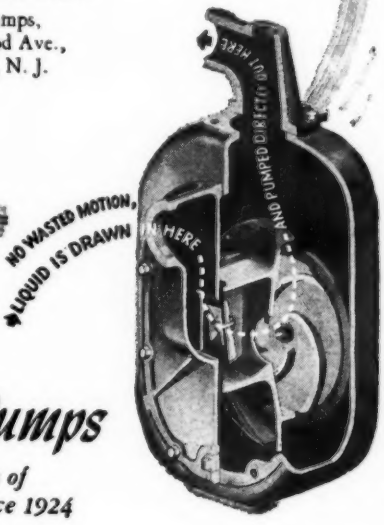


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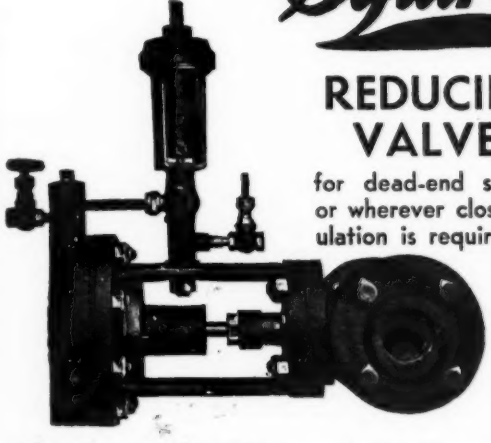

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Fig. 12

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Fig. 21 Fig. 22

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Fig. 48

Fig. 13

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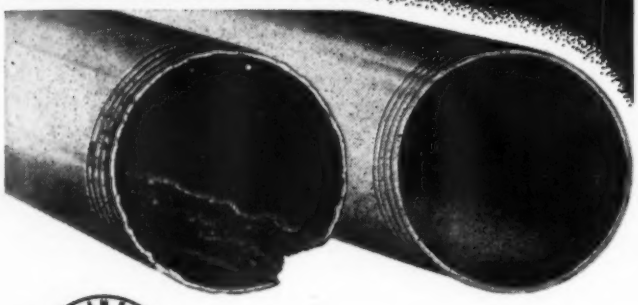

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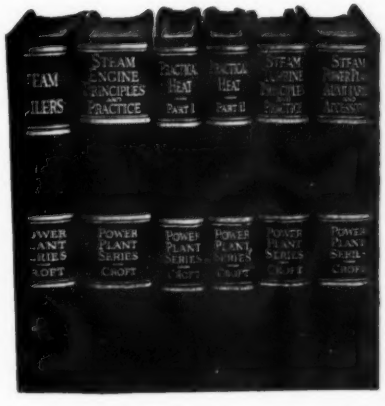


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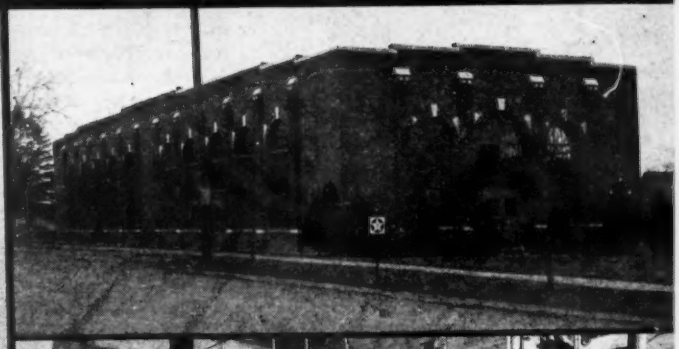

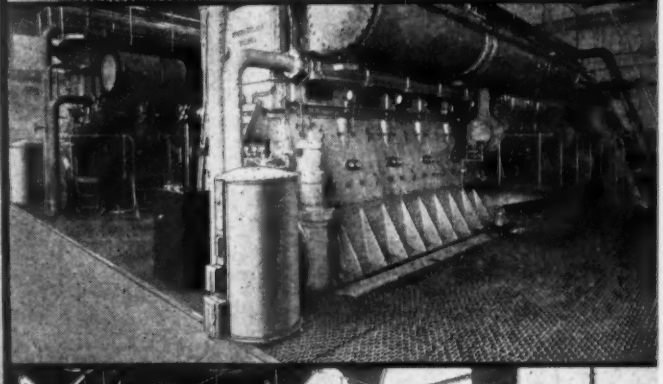

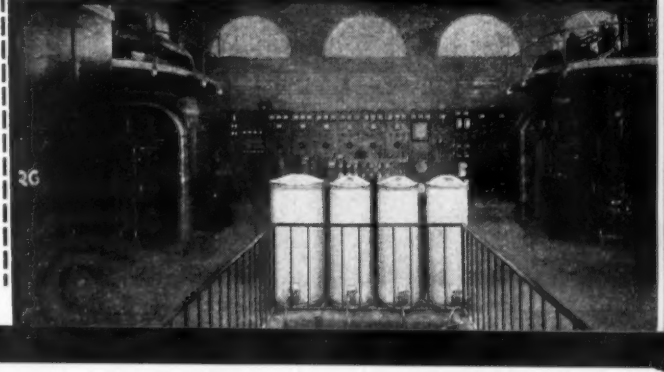

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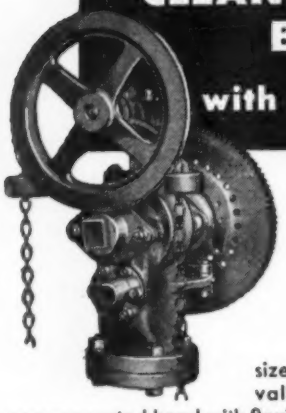

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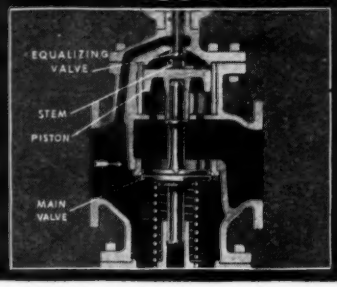


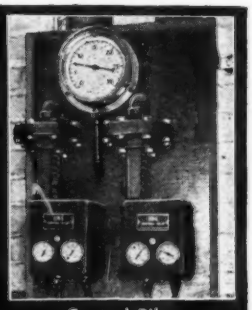

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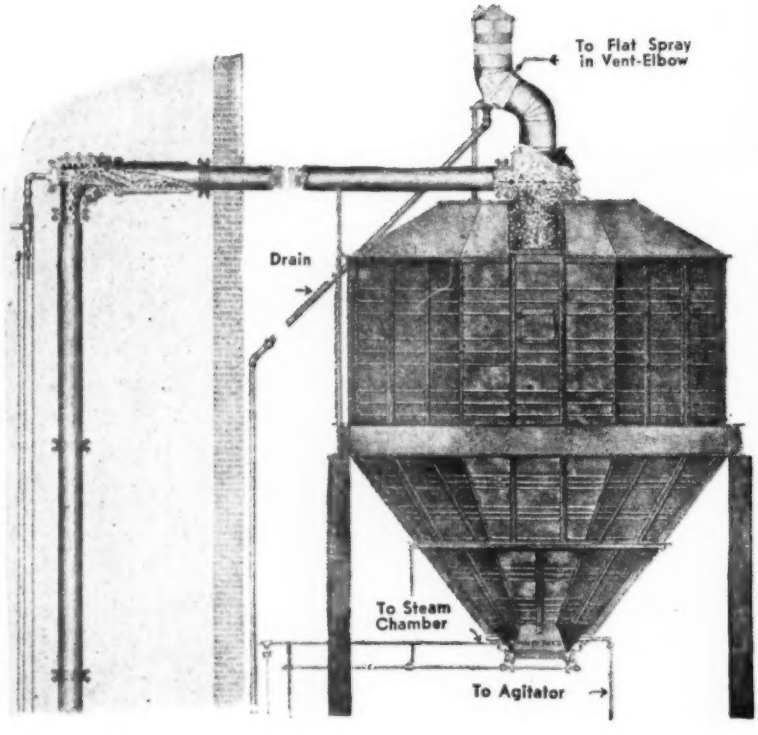


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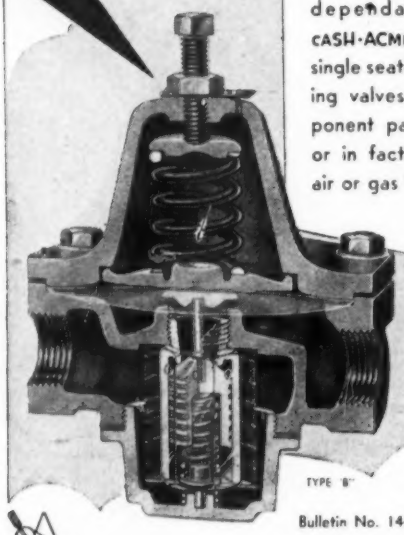

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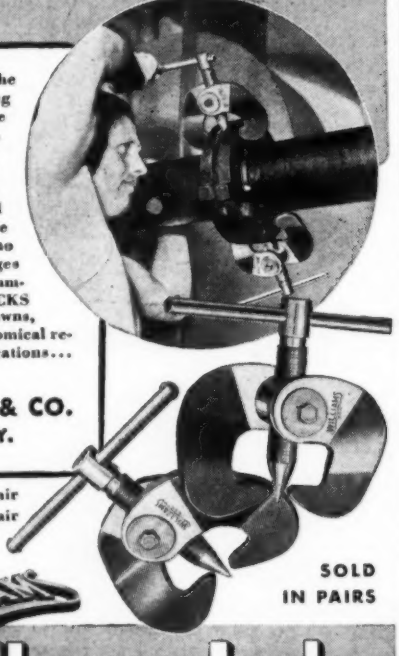

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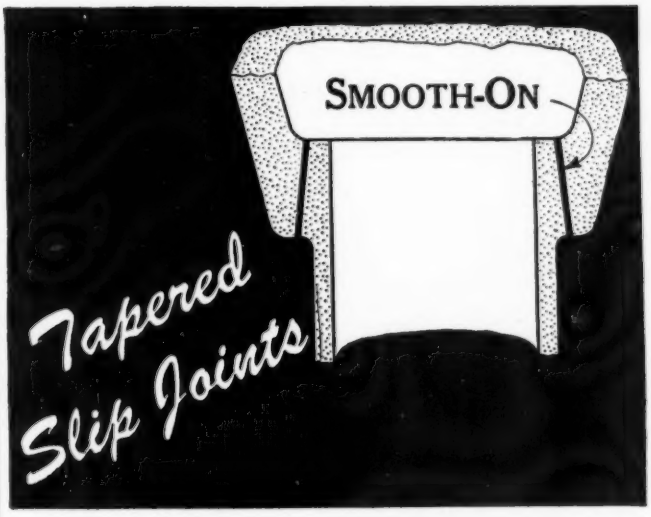


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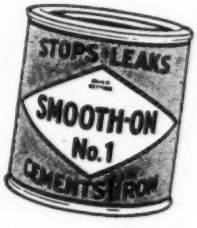


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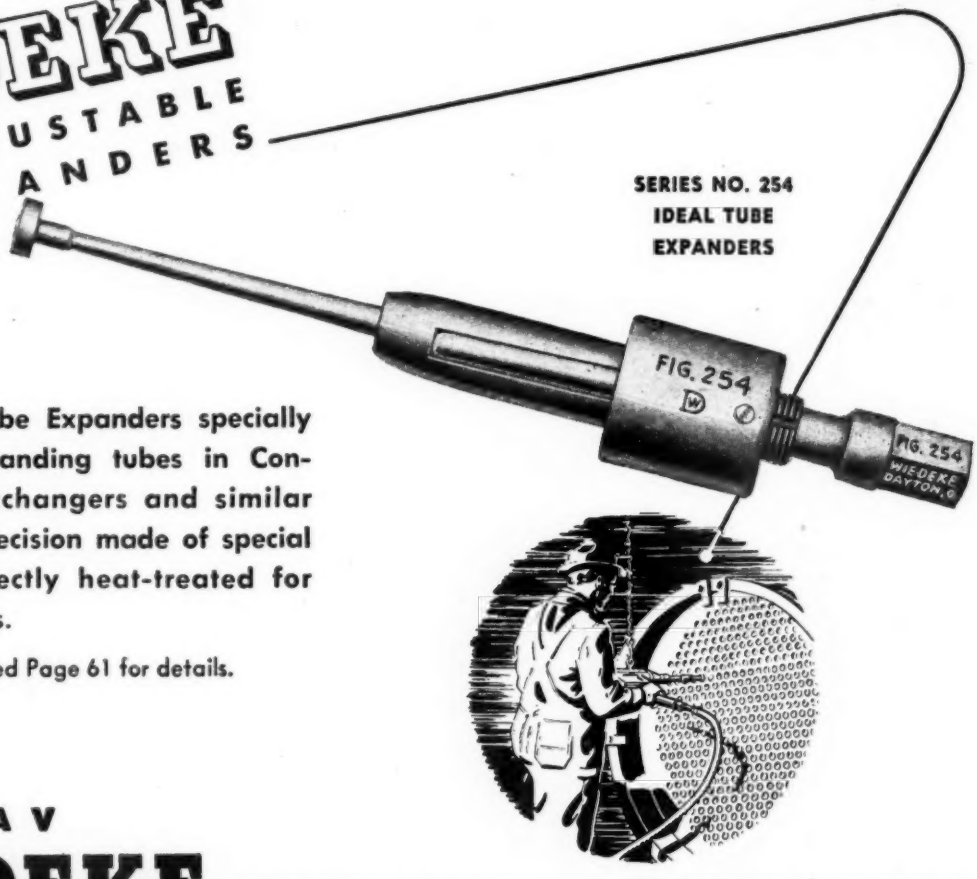


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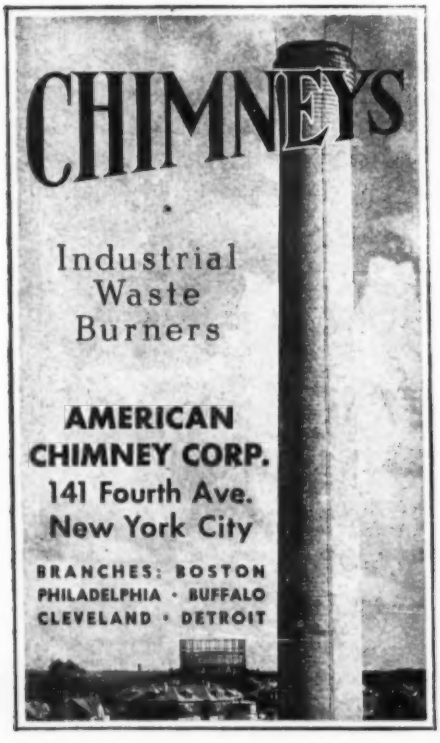

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REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

*Prepared by Bridgeport Brass Company* "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*


# Effect of Water Composition on Condenser Tube Life

"Which condenser tube alloy is best suited to my operating conditions?" This is a leading question which is asked most frequently by power plant engineers.

The first considerations are operating conditions—type of water, water composition, velocity, temperature, extent of contamination, foreign matter, etc. Since all of these factors have a direct bearing on corrosion or tube life, we must choose an alloy which will best resist the corrosive conditions existing at the particular plant in question.

The composition of the water plays an important part in selection of the most suitable copper-base alloy since the alloy and the water interact to form a corrosion film.

### Effect of Water Composition on Corrosion Films

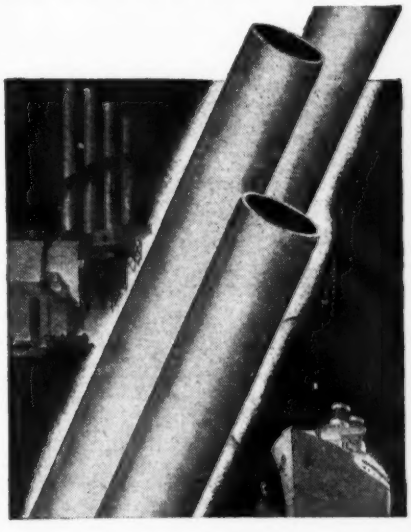
Under certain conditions these films tend to protect the metal and greatly slow up the rate of corrosion. For example, copper exposed to Lake Erie water developed a very thin, varnish-like protective film. On the other hand, the same copper exposed to fresh waters from certain wells and streams (in contact with calcium-rich mineral deposits) became covered with white to grayish-white or reddish colored calcium carbonate scale. This mineral-type scale is also highly protective to copper.

Copper exposed to sea water develops a green-colored film bonded to a red-colored film which in turn is attached to the copper. The outside green-colored film is composed of a mixture of copper salts, and the underlying red-colored film is essentially red cuprous oxide. This layer-type scale is characteristic of that found on copper which is undergoing a low but steady rate of corrosion. If the sea water contains a trace of hydrogen sulphide which results from decomposition of organic matter by bacterial action (0.5 or more parts per million), the green-colored film is changed into a black-colored copper sulphide-rich film and a marked increase in film thickness and corrosion rate results. Copper galvanically coupled with a less noble metal such as iron, steel, aluminum, magnesium, zinc, etc. under certain conditions or exposed to moderately high temperatures in sea water (for example, copper tubing in evaporators) will have formed on its surface white to grayish-white colored calcium-magnesium carbonate scales which are highly protective. This type of film is often objectionable because of its low heat transfer properties.

### Effect of Alloy Composition

Alloy composition also plays an important part in the formation of protective films and consequently in the corrosion resistance of condenser and heat exchanger tubing. The addition to copper of such alloying elements as aluminum, zinc, iron, silicon, tin, arsenic and nickel results in alloys which have varying degrees of corrosion resistance under a wide range of conditions. Data in Tables I and II show how widely corrosion films and corrosion rates vary with the type of alloy and water composition.

No consistent rule can be laid down to correlate film formation with corrosion rate but certain trends can be detected. For example, as the film thickness increases on copper, Admiralty, and Duronze IV, the trend is toward higher corrosion rates. This does not hold true with alloys such as aluminum brass or 70-30 Cupro Nickel. It may be assumed that the presence of thin films (less than 200 milligrams per square decimeter) coincides with low corrosion rates—a conclusion which experience has verified time and again.



### More Investigation Necessary

It is evident that much remains to be learned about the effect of water composition and alloy composition on corrosion films and corrosion rates. At the present time very little is being done about altering the composition of sea water used for cooling purposes, although fresh water is being treated in some cases. More information regarding the effect of water composition on condenser tube life will result from more extensive testing of different alloys under varying conditions, carried out through continued cooperation between power plant engineers, metallurgists, corrosion engineers and condenser tube manufacturers. Examination of condenser and heat exchanger tubing now in use as well as the installation of corrosion test panels and test lots of tubing will be extremely beneficial.

Contact the nearest Bridgeport office for assistance from laboratory trained men who are in a position to give power plant engineers information regarding Bridgeport's many condenser tube alloys. Also write for 112-page Condenser Tube Manual.

**TABLE I**

Weight of Corrosion Film in Milligrams Per Square Decimeter Obtained at 3 Test Sites (1–2 Years' Exposure)

| Alloy | Lake Erie (Fresh Water) | Coast of South Carolina (Harbor Water) | Coast of North Carolina (Clean Sea Water) |
|---|---|---|---|
| Copper | 105 | ... | 750 |
| Arsenical Admiralty | 125 | 472 | 560 |
| Arsenical Aluminum Brass | 89 | 179 | 170 |
| 70-30 Cupro Nickel (0.42% Fe) | 175 | 148 | 81 |
| Duronze IV | 46 | 192 | 550 |

**TABLE II**

Depth of Corrosion of Several Copper-Base Alloys in Mils Per Year at 3 Test Sites (1–2 Years' Exposure)

| Alloy | Lake Erie (Fresh Water) | Coast of South Carolina (Harbor Water) | Coast of North Carolina (Clean Sea Water) |
|---|---|---|---|
| Copper | 0.114 | .... | 1.50 |
| Arsenical Admiralty | 0.129 | 1.09 | 1.51 |
| Arsenical Aluminum Brass | 0.144 | 0.38 | 0.79 |
| 70-30 Cupro Nickel (0.42% Fe) | 0.142 | 0.80 | 0.33 |
| Duronze IV | 0.165 | 0.58 | 1.16 |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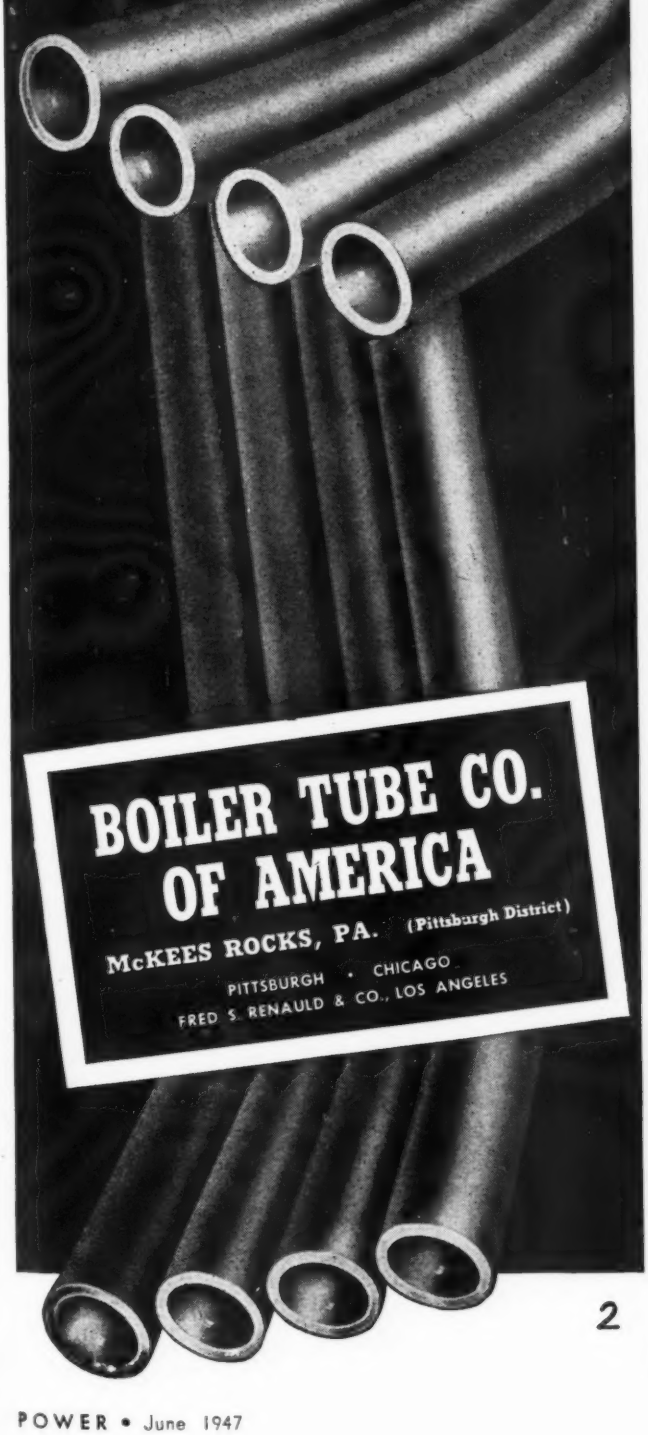

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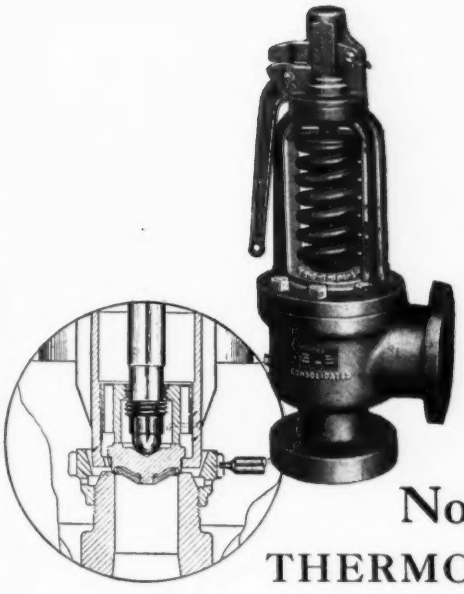

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Coos Bay, Oregon

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**Air Compressors Wanted**

Horizontal Water Cooled—Any size also 2 Stage portable units

**L. W. BAUER**

North Bergen, N. J.

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**WANTED**

**Two D.C. MOTORS**

TYPE MPC, CLASS 8—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-973, Power

330 West 42nd St., New York 18, N. Y.

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**WANTED**

**COMPENSATOR**

1—Manually Operated Compensator for 150 H. P 220 V—60 Cycle—3 phase motor.

**MACK MOLDING COMPANY**

INCORPORATED

WAYNE, NEW JERSEY

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**TRANSFORMERS WANTED**

usable or burnt-out

*IN - STOCK*

*1—1000 KVA-GE Single Ph.*
*2—750 KVA-Pittsburgh—Single Ph.*
*1—30 KVA-GE Constant Current*

**Zenith Transformer Co.**

1733 N. 5th St. Phila. 22, Pa.

Poplar 5-0553

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**WANTED**

**SLIP RING MOTOR**

1—250 HP, 514 RPM, 440 volt, 3 phase, 60 cycles, 3 bearing, slip ring motor with sliding base. 40" width by 24" diameter pulley. With primary and secondary control and grids for starting duty only.

**THE NEW YORK AIR BRAKE COMPANY**

Watertown, New York

---

**WANTED**

**TRANSFORMER**

1—3000 to 4000 KVA 3 phase transformer or equivalent single phase bank. 11.5 KV primary, 2400/4160 secondary. (12 KV primary would be considered). Write

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330 West 42nd St., New York 18, N. Y.

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# HEMPHILL ELECTRICAL ENGINEERS

### MOTOR GENERATOR SETS

1—125 K. W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
1—100 K.W. Electric Machinery, 125 volt, synchronous motor, 4150 volt, 3 phase, 1200 RPM.
1—100 K.W. General Electric, 230 volt, squirrel cage, 440 volt, 3 phase, 1200 RPM.
6—17 K.W. Allis-Chalmers 3 unit 125 V. Sq. Cg. 220 V. 1800 RPM.

### ENGINE GENERATOR SETS

1—150 KVA. G.E. Ames Uniflow Engine, non-condensing.

### TURBO GENERATORS

1—600 K.W. Terry dual bleeder condensing Turbine only.
1—300 K.W. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 K.W. 125 volt Allis-Chalmers non-cond.

### TRANSFORMERS

2—500 KVA. single phase, Allis-Chalmers 7800/13,800 primary, 115/230 secondary.
3—150 KVA. 3 phase, General Electric, type HT, 27,060 primary, 125/216Y secondary.
1—1000 KVA. Auto Transf. 4150 V. 3 ph. 4 wire to 2406 V. 2 PH.
3—100 KVA. Westinghouse 11430/250 volt.
2—100 KVA. General Electric 13200/250 volt.
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
1—1500 KVA, 3 Phase, Allis Chalmers, 2400/4150Y to 480 secondary.
20—Brand new General Electric air-cooled 440/220 volt primary, 220/110 secondary.
20—Brand new ditto only 220 volt primary, 220/110 secondary.
1—15 KVA. Pittsburgh 4000 volt, 110/220 secondary.
3—50 KVA General Electric 2400 volt primary 120/240.

### ALTERNATORS

1—500 K.W. 3600 RPM, 600 volt, General Electric D.C. exciter.
1—200 KVA. 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter.
1—180 K.W. 514 RPM, 550 volt, Westinghouse.
1—165 K.W. 514 RPM, 2400 volt, Electric Mach.
112—KVA. type TS, General Electric, 900 RPM. 220 volt
240 KW, 600 RPM General Electric ATB, direct connected exciter.
1—20 K.W. General Electric, ATB, 720 RPM., 2200 volt, 3 phase, 60 cycle.
1—62½ K.W. 3600 RPM, 230 volt, Allis-Chalmers.
1—40 K.W. 1800 RPM, 550 volt, General Electric.
1—35 K.W. 1200 RPM. 240 volt, Columbia Electric D.C. exciter.
1—31.3 KVA. 1200 RPM. 120/280 volt, American D.C. exciter.
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter.

### MOTORS—VARIABLE SPEED
#### 230 VOLT

2—200 H.P. 425/212 RPM. General Electric MPC.
1— 40 H.P. 755/1000 RPM. Sprague LC.
1— 30 H.P. 400-120 RPM. General Electric RC 204.
1— 25 H.P. 650/2200 RPM. Westinghouse SK1110L.
1— 25 H.P. 500/1500 RPM. General Electric RF-12.
1— 25 H.P. 400/1200 RPM. Westinghouse SK.
2— 25 H.P. 300/900 RPM. Electro Dynamic.
1— 15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic.
3—11½ H.P. 500/1500 RPM. Westinghouse.
1—7½/10 H.P. 500/1500 RPM. Reliance.
1—6/7.5 H.P. 450/1800 RPM. Crocker Wheeler CMC.
1—5 H.P. 500/1500 RPM. Reliance.
1—5 H.P. 600/1200 RPM. General Electric LC.
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM.
1—5 H.P. 400/1600 RPM. Diehl K6.
1—5 H.P. 225/900 RPM. Electro-Dynamic.

### MOTORS 3 PHASE 60 CYCLE
#### SLIP RING

1—500 H.P. 900 RPM. Lincoln 440 volt.
1— 40 H.P. 1150 RPM. Cont. Electric SA85 220 volt.
1— 40 H.P. 1130 RPM. General Electric Mt. 2200 volt.

### MOTORS 3 PHASE 60 CYCLE
#### SQUIRREL CAGE

2—450 H.P. 900 RPM. Ridgway, 2200 volt, 3 phase, 60 cycle.
2—50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt.

### SPECIAL

1—3000 ampere oil circuit breaker, 15,000 volt FK-130-24A—3 pole solenoid operated.

### D. C. GENERATORS

1—75 K.W. 250 V., Westinghouse 260 RPM.
1—50 K.W. 115 V., Westinghouse 1200 RPM.
2—31.2 K.W. 125 V. Westinghouse 1400 RPM.
2—20 K.W. 50 V. G.E. 1800 RPM.

### MOTORS D. C.
#### 230 VOLT

2—450 H.P. General Electric MPL 250 volt, 400 RPM.
1—125 H.P. 1725 RPM. General Electric RC-230 volt.
1— 75 H.P. 575 RPM. General Electric C230 volt.
2— 50 H.P. 700 RPM. Crocker-Wheeler CM 230 volt.
1— 30 H.P. 1100 RPM General Electric RC-12 230 volt.
1— 30 H.P. 625 RPM. General Electric C 230 volt.
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt.
1— 20 H.P. 800 RPM. General Electric RC 12 230 volt.
1— 15 H.P. 350 RPM. Diehl G-322 230 volt.

### SYNCHRONOUS MOTORS

1—75 H.P. 180 RPM. Electric Machinery, 2200 V. 3 phase, 60 cycle.
750 HP 720 RPM, General Electric ATI 2200 volt/4150, 3 phase, 60 cycle.
2—160 H.P. Elec. Mach. 1800 RPM. 220 V. D.C. exciter
1—100 H.P. G.E. type TS, 600 RPM. 440 volt D.C. Exciter.
1—35 KVA. G.E. 1200 RPM. ATI 2200 V. D.C. exciter.
1—20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

### FREQUENCY CHANGERS

1—7½ K.W. 15 KVA. 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse.
2—15 K.W. G.E. Type MM. 270 cy.

### VERTICAL MOTORS

1—75 G.E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1—60 Westinghouse Solid Shaft 900 RPM. 2200 S.R.

### MISCELLLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head.

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# RE-NU-BILT ELECTRICAL EQUIPMENT REBUILT BY SPECIALISTS

## MOTOR GENERATOR SETS

**3 ph. 60 cycle**

1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.

1—600 KW G.E. 3 unit with 2-300 KW 250 v. Gens. d.c. to 850 HP. 2300 v.

1—500 KW G.E. 600 V. d.c. to 700 HP—2300 V.

1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.

1—375 KW—Whse 125 V. d.c. to 600 HP 2300/4000 V. Syn.

1—300 KW G.E. 550 V. d.c. to 435 HP—2300/4000 Syn. with exciter.

1—250 KW G.E. 275 V. d.c. to 350 Kva 2300/4000 Syn. with exciter.

1—250 KW Al. Ch. 250 V. d.c. to 340 Kva—2300 V.

1—150 KW Whse 250 V. d.c. to 250 Kva. 440 V. Syn. with exciter.

1—150 KW Whse 600 V. d.c. to 225 HP—2300 V.

1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.

2—48 KW G.E. 3 unit with (2) 24 KW, 60 V. gens. d.c. to 75 HP, 440 V. Ind.

1—35 KVA Whse. 240v., 3 ph., 60 cy. A.C. gen. with 35 HP—230 V. d.c. motor.

1—30 KW G.E.—250 V. d.c. to 50 HP—220/440 V. 445 Ind.

1—26.4 KW W. E. 33 V. gen. d.c. to 41.5 HP. —220 V. Ind.

1—19.8 KW W. E. 33 V. gen. d.c. to 32 HP —220 V.

### FREQUENCY CHANGER SETS

**1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V—2 ph. 58.3 cycle gen. with exciter (Gen. Can be reconnected for 800 KW 3 ph.)**

**1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V. 3 ph. 25 cycle motor and 1200 Kva.—.7 pf. 2400 V. 3 ph. 60 cycle gen.**

**1—600 KW—GE—2 Unit Consisting of 850 HP—2300 V—3 ph. 25 Cycle Motor and 750 Kva.—.8 pf.—2300 V—3 phase—62½ cycle generator.**

**1—150 KW—Induction type, 2 Unit 4 Bearing—Generator 150 KW—type ITT—557—1800 RPM—500 Volt 3 ph. 120 cycle—Stator excitation 440 Volts with 100 HP—1800 RPM—440 Volt 3 phase 60 cycle Sq. Cage Motor**

## ROTARY CONVERTERS

**60 cycle**

| KW | Make | Speed | Volts | Volts |
|---|---|---|---|---|
| 1—1500 | Whse. | 720 | 600 | 2300 |
| 1—1000 | Whse. | 900 | 600 | 11000 |
| 1— 750 | Whse. | 900 | 600 | 13200 |
| 1— 750 | Whse. | 720 | 250 | 6600 |
| 1— 500 | Whse. | 1200 | 600 | 13200 |

## TURBO-GENERATOR SETS

1—5000 KVA G.E. 2300 V. 3 ph. 60 cy. with G.E. 435 lb. Condensing turbine.

1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy. with Parsons 200 lb. Cond. turbine.

1—3000 KW G.E. 3750 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.

1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.

1—2000 KW G.E. 3125 Kva. 480 V. 3 ph. 60 cy. with 175/200 lb.; 25 lb. auto extraction.

1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.

1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.

1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.

1—1000 KW G.E. 1250 Kva—2300 V.—3 ph. 60 cy. with G.E. 125 lb. and 16 lb. mixed pressure Condensing turbine.

2—1000 KW G.E. 1250 Kva—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.

1—500 KW G.E. 625 Kva—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. with Parsons 145/175 lb. Cond. turbine.

1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.

1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.

1—300 KW Whse. 375 Kva. 480 V. 3 ph. 60 cy. with Whse. 250 lb., 5 lb. back pressure turbine.

1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.

1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non cond. turbine and exciter.

1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.

1—100 Kva. Whse. 2400 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.

1—100 KW G.E. 600 V. 3 ph. 60 cy. with 200 lb. non-cond. turbine and exciter.

1—75 KW. Ridgeway 250 V. d.c. with Terry 180 lb., 12 lb. back pressure turbine.

1—50 KW N. W. 220 V. 3 ph. 60 cy. with 100 lb., 15 back pressure turbine.

### SPECIAL

**1—2000 Amp. 3 PST. 15,000 V. Sol. operated, conduit, type, F-12—15 D. OCD.—1,000,000 KVA, interrupting capacity. Unused.**

## A. C. MOTORS

**3 ph. 60 cycle**

### SYNCHRONOUS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—2100 | G.E. | ATI | 2300/4600 | 514 |
| 2— 600 | Al. Ch. | | 2300 | 720 |
| 2— 350 | G.E. | TS | 2200 | 150 |
| 1— 300 | Whse. | | 600 | 600 |
| 1— 200 | El. Mach. | | 440 | 900 |

### SLIP RING

| | | | | |
|---|---|---|---|---|
| 1—2500 | G.E. | MT | 6600 | 253 |
| 1—1000 | Whse. | CW | 2300 | 705 |
| 1— 800 | Whse. | CW | 6600 | 443 |
| 1— 750 | Whse. | CW | 2200 | 327 |
| 1— 450 | Cr. Wh. | SR-310 | 2300 | 392 |
| 1— 350 | G.E. | MT-442Y | 2200/4000 | 253 |
| 1— 250 | G.E. | MT-424Y | 4000 | 257 |
| 1— 225 | G.E. | IM-17 | 550 | 705 |
| 1— 100 | Al. Ch. | ANY | 220 | 435 |
| 1— 75 | F.M. | BY | 2200 | 1750 |
| 3— 50 | Whse. | CI | 220 | 870 |

### SQUIRREL CAGE

| | | | | |
|---|---|---|---|---|
| 1—250 | G.E. | IK | 440 | 600 |
| 1—250 | Al. Ch. | AN | 220 | 1160 |
| 1—200 | Al. Ch. | AN | 2300 | 1160 |
| 1—200 | Al. Ch. | IK | 2300 | 1175 |
| 1—200 | G.E. | IK | 440 | 900 |
| 1—150/70 | G.E. | IK | 440 | 1170/870 |
| 1—100 | G.E. | IK (Vert.) | 2300 | 450 |
| 3—100 | G.E. | IK | 2200 | 600 |

### SPECIAL MERCURY ARC RECTIFIERS

**1—750 Kw—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 Cycle transformer and switching equipment.**

**1—500 KW—GE—Type RHW—6 anode 575 V. D.C. Form B with 2300 V. 60 Cycle transformer and switching equipment.**

## D. C. MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—800/1000 | Whse. | | 450 | 600/720 |
| 1—800 | G.E. | MPC | 600 | 600 |
| 1—700 | G.E. | MCF | 600 | 150/525 |
| 1—650 | G.E. | MPC | 250 | 115/145 |
| 2—350 | G.E. | MPC | 250 | 450 |
| 1—335 | Whse. | MQ | 250 | 300/900 |
| 1—300 | G.E. | DMC | 230 | 400/600 |
| 1—300 | Cr. Wh. | CCM-151H | 230 | 630/700 |
| 1—300 | G.E. | MPC | 230 | 275/550 |
| 1—250 | G.E. | MPC | 230 | 400/500 |
| 1—150 | G.E. | MPC | 230 | 250/450 |
| 1—130 | Cr. Wh. | CMC-51H | 550 | 1200 |
| 2—125 | G.E. | CO-1832 | 230 | 625 |
| 1—125 | Whse. | | 240 | 240/600 |
| 1— 75 | Rel. | 385T | 230 | 1330/1760 |
| 2— 75 | Cr. Wh. | CMC | 230 | 1150/1760 |

## D. C. GENERATORS

| KW | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—1200 | Al. Ch. | MHC | 525 | 750 |
| 1— 500 | G.E. | MPC | 600 | 720 |
| 1— 300 | G.E. | MPC | 250 | 525 |
| 1— 155 | G.E. | MPC | 250 | 720 |
| 1— 150 | G.E. | MPC | 125 | 200 |
| 2— 100 | Whse. | | 240 | 250 |

39th BELYEA YEAR

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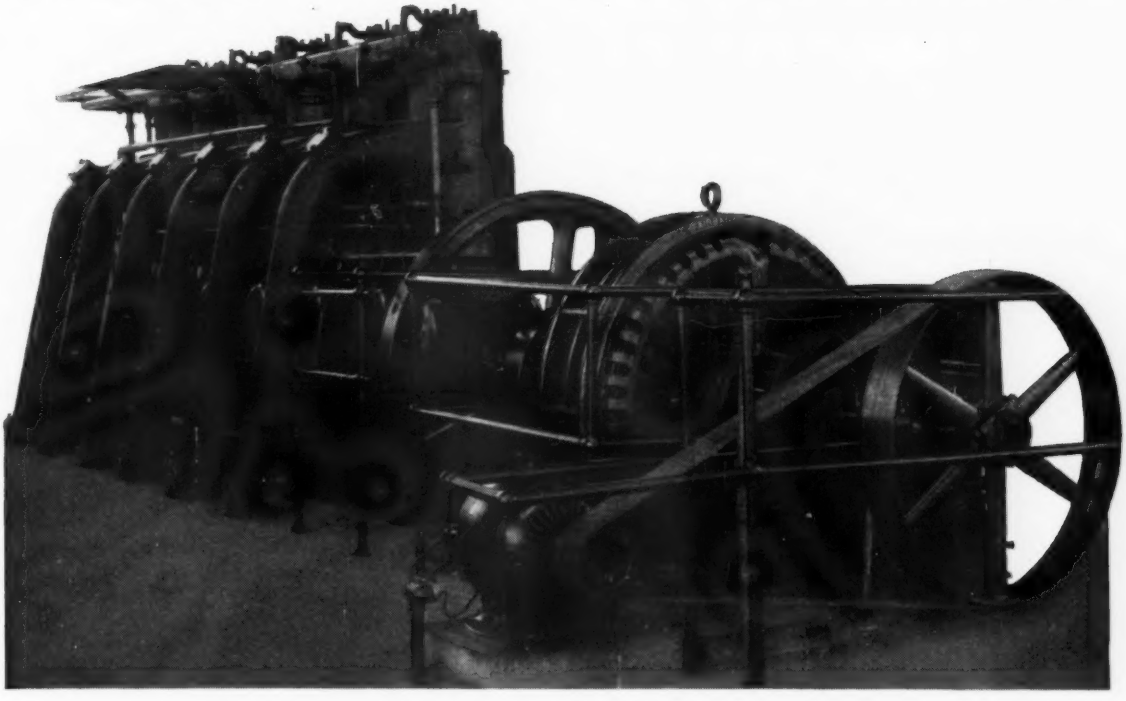
# POWER PLANT MACHINERY



**250 KVA FAIRBANKS MORSE DIESEL ENGINE GENERATOR UNIT**

**250 KVA Fairbanks Morse alternating current generator 3 phase 60 cycle 2300 volts 257 RPM direct connected to 300 HP Fairbanks Morse full diesel oil engine, 6 cylinders, type Y, style VA, model 32, 257 RPM.**

***Excellent condition. Can be shown in operation.***

## CONDENSING TURBO UNITS

### 3 phase 60 cycle

12500 KVA G.E. 2400 volts 275# steam
5000 KVA G.E. 2300 volts 200# steam
3125 KVA Wstgh. 2300 volts 200# steam
2500 KVA G.E. 480 volts 150# steam
2250 KVA G.E. 2300 volts 400# steam
1563 KVA Allis 2300 volts 200# steam
1250 KVA G.E. 600 volts 250# steam
1250 KVA (2) G.E. 480 volts 150# steam
937 KVA G.E. 2300 volts 150# steam
750 KVA G.E. 2300 volts 210# steam
625 KVA Wstgh. 2300 volts 250# steam

## EXTRACTION TURBO UNITS

### 3 phase 60 cycle

7500 KVA G.E. 13800 volts 400# steam, 135-165# extraction
3750 KVA Wstgh. 2300 volts 150# steam, 10# extraction
1250 KVA Allis 480 volts 250# steam, 25# extraction
940 KVA Wstgh. 600 volts 150# steam, 20# extraction
625 KVA Wstgh. 480 volts 250# steam, 25# extraction

## BOILERS

90,000 lbs/hr Combustion Engineering 550 lbs/steam, 700 deg.T.T., pulverizer
37,500 lbs/hr Heine 400 lbs. steam, 620 deg. T.T., oil burner
35,000 lbs./hr Foster Wheeler 325 lbs. steam, 570 deg.T.T., oil burner
30,000 lbs/hr. B & W 425 lbs. steam, 600 deg. T.T., pulverizer

## NONCONDENSING TURBO UNITS

### 3 phase 60 cycle

2500 KVA G.E. 480 volts 150# steam, 15# exhaust
1563 KVA Kerr 2300 volts 200# steam, 15# exhaust
937 KVA Wstgh. 480 volts 400# steam, 60# exhaust
937 KVA Moore 2300 volts 175# steam, 20# exhaust
875 KVA Moore 2300 volts 300# steam, 100# extraction, 5# exhaust
750 KVA G.E. 480 volts 550# steam, 40#
750 KVA G.E. 480 volts 115# steam, 5# exhaust
625 KVA Wstgh. 480 volts 225# steam, 10# exhaust
375 KVA G.E. 480 volts 150# steam, 20# exhaust
187 KVA G.E. 480 volts 250# steam, 15# exhaust

## MOTOR GENERATOR SETS

### 3 phase 60 cycle

300 KW Ridgeway, 250 volts D.C., 2200 volts A.C.
250 KW C.W. 250 volts D.C., 440 volts A.C.
200 KW C.W. 125 volts D.C., 2300 volts A.C.

## ROTARY CONVERTERS

### 3 phase 60 cycle—

2000 KW Allis 600 volts D.C., 4150 volts A.C.
1500 KW Wstgh. 250 volts D.C., 2300 volts A.C.
1000 KW G.E. 600 volts D.C., 3300 volts A.C.
750 KW G.E. 600 volts D.C., 12000 volts A.C.
500 KW G.E. 600 volts D.C., 33000 volts A.C.

## UNIFLOW UNITS

### 3 phase 60 cycle

750 KVA Nordberg, 2300/480 volts 200# steam 15# exhaust
560 KVA Skinner, 480 volts, 150# steam, 20# exhaust
375 KVA Skinner 2300 volts, 150# steam 5# exhaust
375 KVA (2) Skinner (vertical) 240 volts 150# steam, 5# exhaust
312 KVA Skinner 480 volts, 150# steam, 5# exhaust

## DIESEL UNITS

### 3 phase 60 cycle

625 KVA Fulton, 480 volts, 164 RPM
575 KVA McIntosh-Seymour, 2300 volts 225 RPM
500 KVA (2) McIntosh-Seymour, 2300 volts 164 RPM
450 KVA Busch-Sultzer, 480 volts, 200 RPM
250 KVA Fairbanks Morse, 2300 volts 257 RPM
170 KVA Fairbanks Morse, 240 volts, 257 RPM

## GENERATORS

### 3 phase 60 cycle

2000 KVA G.E. 480 volts 300 RPM
1625 KVA Wstgh. 2400 volts 240 RPM
650 KVA G.E. 600 volts 360 RPM
538 KVA E.M. 2400 volts 327 RPM
125 KVA Wstgh. 2400 volts 327 RPM

**INTERNATIONAL POWER MACHINERY CO.**

**UNION COMMERCE BLDG.** **Telephone Main 9514** **CLEVELAND 14, OHIO**

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## 1 YEAR GUARANTEE

### 125 V. - 250 V. - 550 V. D.C. GENERATORS (Motor Driven and Belted)

| KW | Make | Voltage | Ampere | Speed |
|---|---|---|---|---|
| 300 | Al. Ch. | 250/125 | 1200 | 1200 |
| 250 | G.E. | 125 | 2000 | 690 |
| 200 | G.E. | 125V | 1600 | 900 |
| 200 | Cr. Wh. | 550 | 363 | 900 |
| 150 | G.E. | 250 | 600 | 580 |
| 150 | G.E. | 125 | 1200 | 1200 |
| 150 | West | 250 | 600 | 1150 |
| 100 | G.E. | 250 | 400 | 900 |
| 100 | G.E. | 125 | 800 | 730 |
| 100 | G.E. | 125 | 800 | 1150 |
| 75 | Cr. Wh. | 125 | 600 | 1150 |
| 60 | G.E. | 125 | 480 | 900 |
| 40 | G.E. (8) | 250 | 160 | 1150 |
| 40 | Century | 125 | 320 | 1450 |
| 40 | West. | 250/125 | 160 | 1500 |
| 40 | G.E. | 250 | 160 | 800 |
| 25 | Allen | 110 | 320 | 500 |
| 30 | G.E. | 250 | 120 | 1750 |
| 20 | Delco | 125 | 160 | 1200 |
| 20 | West (6) | 125 | 120 | 1200 |
| 20 | Col. (3) | 125 | 160 | 1750 |
| 15 | G.E. | 125 | 120 | 1750 |
| 15 | West. | 230 | 60 | 1450 |
| 15 | G.E. | 125 | 120 | 1150 |
| 15 | G.E. | 125 | 120 | 850 |
| 12½ | F.M. | 125 | 100 | 1450 |
| 10 | Rogers (2) | 125 | 80 | 1450 |
| 10 | El. Dy. | 125 | 80 | 600 |
| 8 | G.E. (2) | 125 | 64 | 1800 |
| 7½ | G.E. | 125 | 60 | 1800 |
| 5 | G.E. (2) | 125 | 40 | 1740 |
| 5 | Rel. | 250 | 20 | 1725 |

80—Additional generators—125 V. up to 200 V generators in stock.

### LOW VOLTAGE D.C. GENERATORS

| KW | Make | Voltage | Ampere | Speed |
|---|---|---|---|---|
| 75 | G.E. | 75 | 1000 | 1145 |
| 22½ | West. | 75 | 300 | 720 |
| 90 | Century | 60 | 1600 | 1150 |
| 24 | G.E. | 60 | 400 | 1800 |
| 1-1/8 | G.E. | 60 | 19 | 1800 |
| 3 | Hertner | 60 | 60 | 1730 |
| 40 | G.E. (6) | 50 | 800 | 1160 |
| 8½ | G.E. | 42 | 205 | 1800 |
| 5 | Diehl | 40 | 125 | 1750 |
| 33 | G.E. | 33 | 1000 | 850 |
| 6½ | G.E. | 32 | 205 | 1800 |
| 3 | G.E. | 30 | 100 | 1200 |
| | West. | 30 | 1600 | 600 |
| 6 | Star (2) | 25 | 250 | 1800 |
| 5 | Star | 25 | 200 | 1750 |
| 15 | Rel. | 24 | 625 | 1450 |
| 4 | Star | 20 | 200 | 1800 |
| 106 | El. Pr. | 18 | 6000 | |
| | | 30 | 3000 | 600 |
| 1 | West. | 16 | 60 | 1750 |
| 11 | Star | 15 | 750 | 1200 |
| 1 | Cont. (2) | 15 | 67 | 1750 |
| 4½ | Star | 15 | 300 | 1800 |
| 30 | Columbia | 8-16 | 5000/2500 | 720 |
| 12 | H.V.W. | 12/14 | 1000/500 | 900 |

300—Additional low voltage generators in stock

**(4) 600 H. P.**
**Westinghouse Synchronous**
**Motors—900 RPM**
**3 ph. 600 cy. 2300 Volt**

**Motor Generator**
**Set Exciter**

**Manual Reduced**
**Voltage Starting Equipment**

**3 Years old — Like new**

### 230 V. D. C. MOTORS

| Qu | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 125 | West. | SK | 825 |
| 1 | 100 | West. | SK-180 | 625 |
| 1 | 100 | Rel. | | 475/635 |
| 3 | 100 | Rel. | 1050T | 400/1200 |
| 1 | 75 | West. | SK | 475 |
| 1 | 75 | Cr. Wh. | New | 480/670 |
| 3 | 60 | West. | SK-160 | 680 |
| 1 | 60 | G.E. | C | 480/1100 |
| 1 | 50 | West. | CK-9 | 525 |
| 1 | 45 | Diehl | K-10 | 850 |
| 2 | 40 | G.E. | DLC-25 | 1050 |
| 8 | 40 | G.E. | CD1441 | 250/1500 |
| 1 | 40 | Cr. Wh. | CCM | 700 |
| 1 | 35 | G.E. | RLC-204 | 440/800 |
| 1 | 35 | West. | SK-160 | 400 |
| 1 | 30 | G.E. | RC-32 | 1100 |
| 1 | 30 | West. | S-6 | 1025 |
| 1 | 30 | West. | SA | 975 |
| 2 | 30 | West. | SA | 500/1500 |
| 2 | 25 | G.E. | RC-31 | 1150 |
| 1 | 25 | West. | SK | 1100 |
| 1 | 25 | Rel. | 92T | 1150 |
| 1 | 25 | West. | SK | 900 |
| 4 | 25 | G.E. | RF-12 | 500/1500 |
| 1 | 25 | West. | SK | 500/1500 |
| 1 | 25 | G.E. | RF-11 | 500/1500 |
| 2 | 25 | G.E. | RF-14 | 300/1200 |
| 1 | 25 | G.E. | RF-14 | 300/900 |
| 1 | 25 | West. | SA | 325/975 |
| 1 | 20 | G.E. | CD-85 | 1150 |
| 1 | 20 | G.E. | RC-11 | 1150 |
| 1 | 20 | West. | SK-103 | 1200 |
| 1 | 20 | West. | S-6 | 975 |
| 2 | 20 | West. | SK-83 | 850 |
| 1 | 20 | G.E. | RC | 800 |
| 1 | 20 | Al. Ch. | Series | 625 |
| 1 | 20 | West. | HY-6 | 700 |
| 1 | 20 | G.E. | RF-11 | 500/1500 |
| 10 | 20 | G.E. | RF-12 | 400/1200 |
| 2 | 20 | Star | SHB-20 | 29.2 |
| 2 | 16/25 | Cr. Wh. | 35-JA | 400/1200 |
| 1 | 15 | Roch. | | 3450 |
| 4 | 15 | Star | SQ-1520 | 1290 |
| 1 | 15 | G.E. | RC | 1200 |
| 1 | 15 | West. | SK-80L | 1100 |
| 1 | 15 | G.E. | RC-29 | 1150 |
| 1 | 15 | G.E. | RC-10 | 1150 |
| 1 | 15 | G.E. | CDC-85 | 900 |
| 1 | 15 | West. | SK | 850 |
| 1 | 15 | G.E. | CDE-83 | 850 |
| 2 | 15 | G.E. | RC-30 | 850 |
| 1 | 15 | West. | SK | 675/1350 |
| 1 | 15 | El. Dy. | 5S | 600/1200 |
| 1 | 15 | G.E. | CQ ¾ | 600/1500 |
| 1 | 15 | G.E. | LC | 675/1150 |
| 2 | 15 | West. | SK-100L | 600/1500 |
| 1 | 15 | G.E. | RF-11 | 400/1600 |
| 1 | 15 | West. | SK | 250/1100 |
| 1 | 15 | Diehl | | 200/247 |
| 1 | 10 | G.E. | CD-75 | 1150 |
| 1 | 10 | G.E. | RC | 1100 |
| 1 | 10 | Triumph | TR-10S | 860 |
| 1 | 10 | G.E. | RC-29 | 850 |
| 1 | 10 | Diehl | LS-14 | 750 |
| 1 | 10 | West. | SK-7L | 700 |
| 1 | 10 | Cr. Wh. | CSM | 675 |
| 1 | 10 | West. | SK | 600/1200 |
| 2 | 10 | G.E. | RLC | 500/1500 |
| 1 | 10 | G.E. | RF-10 | 400/1600 |
| 1 | 10 | West. | SA | 400/1200 |
| 1 | 10 | G.E. | RF-10 | 400/1200 |
| 1 | 10 | Rel. | 131T | 250/1000 |
| 2 | 10 | West | Gr.Hd. | 3/10 |
| 1 | 7½ | Sturt | | 3600 |
| 1 | 7½ | L.A. | 284 | 1750 |
| 1 | 7½ | El. Dy. | 2S | 1750 |
| 5 | 7½ | Cr. Wh. | New | 1750 |
| 1 | 7½ | G.E. | RC | 1700 |
| 1 | 7½ | West. | SK | 1800 |
| 2 | 7½ | Cr. Wh. | CCM | 1425 |
| 3 | 7½ | West. | SK | 1100 |
| 1 | 7½ | G.E. | RC | 1100 |
| 1 | 7½ | G.E. | CO-1804 | 1200/3200 |
| 2 | 7½ | West. | SK-50 | 975 |
| 1 | 7½ | G.E. | RC | 900 |
| 1 | 7½ | Cr. Wh. | CCM | 875 |
| 2 | 7½ | G.E. | RC | 850 |
| 1 | 7½ | West. | SK-60 | 850 |
| 1 | 8½ | West. | SK-30 | 825 |
| 1 | 7½ | G.E. | RF-10 | 600/1500 |
| 1 | 7½ | West. | SK-90 | 650/1300 |
| 1 | 7½ | El. Dy. | 3S | 550/1650 |
| 2 | 7½ | L.A. | BW-15 | 525/1150 |
| 1 | 7½ | Roth | RS-107 | 450/900 |
| 1 | 7½ | West. | SK-70 | 400/1600 |
| 1 | 7½ | West. | SA | 400/1600 |
| 1 | 7½ | G.E. | RLC | 400/1600 |
| 1 | 7½ | Al. Ch. | | 350/1050 |
| 1 | 5 | Star | SB-5 | 1750 |
| 1 | 5 | Rel. | T-254 | 1750 |
| 2 | 5 | G.E. | RC | 1700 |
| 1 | 5 | G.E. | CDV | 1750 |
| 1 | 5 | G.E. | CVC | 1650 |
| 1 | 5 | G.E. | CD-65 | 1150 |
| 1 | 5 | Rel. | 32T | 1150 |
| 8 | 5 | G.E. | RC-27A | 1150 |
| 2 | 5 | West. | SK-43 | 1150 |
| 1 | 5 | G.E. | B-284 | 1150 |
| 1 | 5 | West. | SC-3 | 870/1750 |
| 1 | 5 | Rel. | 23T | 850/1700 |
| 1 | 5 | Al. Ch. | E-75 | 850 |
| 1 | 5 | G.E. | RC | 600 |
| 1 | 5 | Cont. | D-49 | 600/1800 |
| 1 | 5 | Star | SB-10 | 600/1200 |
| 1 | 5 | El. Dy. | 3-S | 550/1650 |
| 2 | 5 | West. | SK-60 | 500/1500 |
| 1 | 5 | Cr. Wh. | CM | 400 |
| 2 | 3 | G.E. | BD-235 | 3600 |

800—Smaller D.C. motors in stock including fractional.

### 110 V. D.C. MOTORS

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 60 | Star | SQ-60L | 1200 |
| 1 | 25 | Star | 15-L | 2400 |
| 1 | 25 | G.E. | CDM-95 | 1000 |
| 1 | 20 | G.E. | CD-83 | 1750 |
| 1 | 16 | Cr. Wh. | CMC-L | 1750 |
| 1 | 15 | West. | | 1150 |
| 1 | 15 | El. Dy. | 7½ S | 615/1230 |
| 1 | 15 | West. | S | 560 |
| 4 | 10 | Lincoln | | 3500 |
| 1 | 10 | L. A. | | 3500 |
| 1 | 10 | Al. Ch. | EBC-75 | 2175 |
| 1 | 10 | G.E. | CD-73 | 1750 |
| 1 | 10 | West. | SK-70L | 850 |
| 1 | 10 | Cont. | | 825 |
| 1 | 10 | Rel. | | 400/1600 |
| 1 | 10 | Diehl. | | 230 |
| 1 | 7½ | I.G.E. | | 1300 |
| 1 | 7½ | Cr. Wh. | | 1700 |
| 1 | 7½ | West. | S | 975 |
| 1 | 7½ | G.E. | CVC | 825 |
| 1 | 7½ | El. Dy. | 5 S | 450/900 |
| 1 | 7½ | West. | SK-294 | 84 |
| 1 | 7½ | El. Dyn. | 5S | 600/1200 |

600—Smaller size 110 V. D. C. motors including fractional horsepower motors also in stock.

**NEW**

**Totally Enclosed Fan Cooled MOTORS**

**3 ph. 60 cy. 220 & 440 volt all NEMA frame 405**

36—25/11 H.P. G.E., 1800/1200 RPM

81—12½/7 H.P. Wagner, 1160/870 RPM

7—10 H.P. G.E. & Wagner, 580 RPM

13—15 H.P. G.E. & Wagner 700 RPM

27—20 H.P. G.E. & Wagner 870 RPM

31—25 H.P. G.E. & Wagner 1170 RPM

23—30 H.P. G.E. & Wagner 1745 RPM

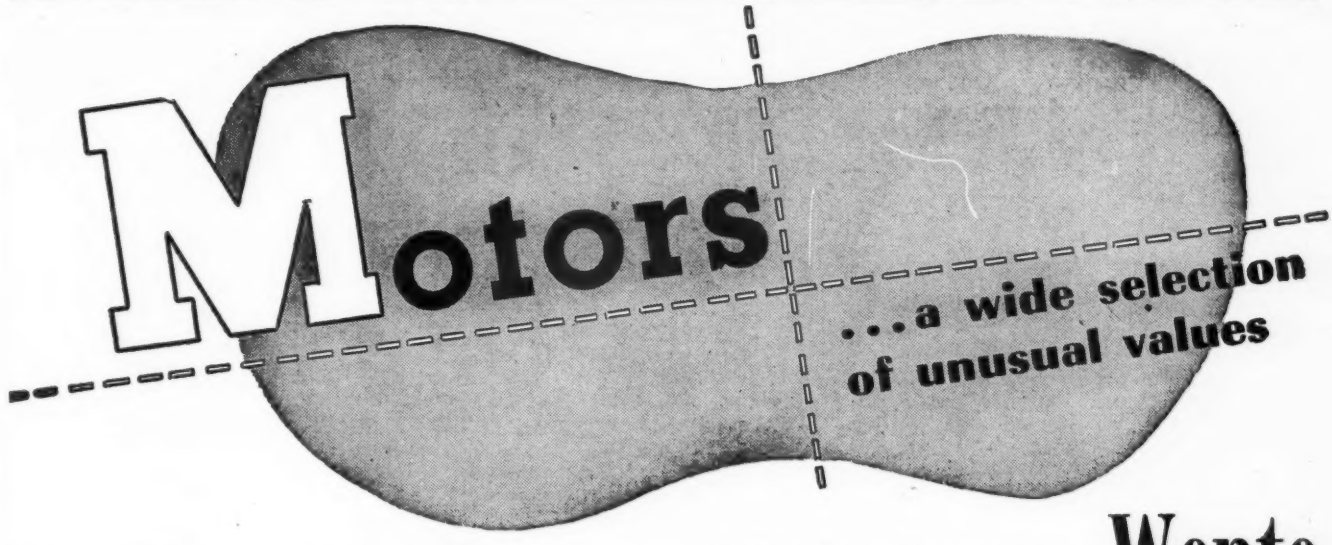
**SEND US YOUR INQUIRIES FOR A. C. EQUIPMENT**

# L. J. LAND, INC.

Established 1910 — **146 GRAND STREET, NEW YORK 13, NEW YORK** — CAnal 6-6976

*New England Representative*
**BOSTON, MASS., 411 Atlantic Ave.**
*Phone:* **Liberty 4300**

*Pennsylvania Office*
**READING, PA., 10th & Exeter Sts.**
*Phone:* **Reading 2-6866**




# Listed below a few of the motors available in a hurry from Wente

### SQUIRREL CAGE

**3 Phase, 60 Cycle, 220/440 Volt.**

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 300 | G.E. 440v. | ATI Syn. | 1800 RPM |
| 1 | 250 | G.E. 440v. | KF Vert. | 3600 RPM |
| 1 | 150 | Al. Ch. | | 1750 |
| 1 | 125 | Cr. Wh. | 125Q | 430 RPM |
| 1 | 150 | G.E. | 1-550V | 380 RPM |
| 1 | 100 | West. 2200v. | CCL | 1720 |
| 1 | 100 | G.E. | I | 340 |
| 1 | 100 | G.E. | I | 290 |
| 1 | 100 | G.E. 440v. | PCS | 375 RPM |
| 1 | 50 | G.E. 2200v. | I-K | 900 RPM |
| 1 | 50 | G.E. | I | 720 |
| 2 | 50 | West. | MS 25 cy. | 720 |
| 1 | 50 | Wag. | BM | 495 |
| 1 | 50 | Al. Ch. | | 490 |
| 1 | 40 | West. 220cy. | CS | 870 RPM |
| 1 | 40 | G.E. | KT542 | 720 RPM |
| 2 | 35 | Al. Ch. | 2 hp. | 865 |
| 2 | 35 | Al. Ch. | | 865 |
| 1 | 35 | Ft. Wayne | 2 ph. | 900 |
| 1 | 35 | G.E. | 25 cy. | 720 |
| 1 | 30 | Cr. Wh. | | 860 RPM |
| 1 | 30 | Al. Ch. 2200v. | | 690 RPM |
| 1 | 30 | F.M. 2200v. | HD12B | 3600 |
| 1 | 30 | Al. Ch. | | 1200 |
| 1 | 20 | Louis A. | KH | 1170 |
| 1 | 30 | West. | CCL | 900 |
| 2 | 30 | Al. Ch. | An 2 ph. | 860 |
| 1 | 30 | Century | AS 25 cy. | 720 |
| 1 | 25 | Howell | | 1200 |
| 1 | 25 | Lincoln | | 900 |
| 1 | 25 | Al. Ch. | | 860 |
| 1 | 25 | Al. Ch. | | 720 |
| 1 | 25 | G.E. | M10 | 720 |
| 1 | 25 | Burke | EM | 900 RPM |
| 1 | 20 | F. M. | KRV | 1200 |
| 1 | 20 | Clev. | M-147 | 900 |
| 1 | 20 | Al. Ch. | | 860 |
| 2 | 20 | U.S. | SC splash proof, ball beating | 1800 RPM |
| 1 | 20 | West. | CS | 1750 RPM |
| 1 | 20 | G.E. 2200v. | I | 900 RPM |
| 2 | 20 | (New West | 220/440v. CS404, 1200 RPM | |
| 1 | 18 | West. | MS-4 (Elev.) | 720 |
| 1 | 15 | West. | CCL | 1700 |
| 1 | 15 | G.E. | KT | 1750 RPM |
| 1 | 5 | Star | SB 3 (totally enclosed ball bearing) | 1200 RPM |
| 1 | ½ | G.E. | KT | 1800 RPM |
| 2 | 15 | West. | CS-573 25 cy. | 725 |
| 2 | 15 | West. | MS 25 cy. | 725 |
| 1 | 15 | West. | CS567C 25 cy. | 715 |
| 1 | 15 | West. | MS 25 cy. | 600 |
| 1 | 10 | West. | CS 25 cy. | 725 |
| 1 | 10 | West. | MS 25 cy. | 720 |
| 2 | 10 | West. | CS473C 25 cy. | 615 |

### SLIP RING

**3 Phase, 60 Cycle, & Syn.**

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 443 | El. Mach. | | 900 Syn |
| 1 | 200 | F.M. | BV | 600 |
| 2 | 75 | F.M. 2200v. | BV-H16B | 1800 |
| 1 | 50 | Triumph | C12 | 1150 |
| 1 | 50 | Ideal 2200v. | AV | 575 |
| 1 | 50 | G.E. | 1M 25 cy. | 700 |
| 1 | 50 | Al. Ch. | | 690 |
| 1 | 50 | West. 220v. | CW752 | 690 RPM |
| 1 | 50 | West. | CW752C | 900 RPM |
| 2 | 40 | G.E. | MT336 | 1200 |
| 1 | 40 | Al. Ch. | | 1160 |
| 1 | 40 | W'g 2200v. | CW | 870 |
| 1 | 40 | Westg. | CW-658-A | 870 |
| 2 | 40 | Al. Ch. | | 870 |
| 1 | 40 | Westg. | C1753A 25 cy. cr. | 730 |
| 10 | 35/15 | G.E. | OMT336 | 1150/550 |
| 1 | 35 | Al. Ch. | 25 cy. | 720 |
| 2 | 35 | G.E. | IM | 570 |
| 1 | 30 | F.M. | AD Alt. | 1200 |
| 1 | 22 | G.E. | ITC5011 (hoist) | 680 |
| 1 | 25 | Westg. | CW | 690 RPM |
| 1 | 25 | Cr. Wh. | | 1155 RPM |
| 1 | 25 | Westg. | MW322A | 680 |
| 1 | 25 | G.E. | MT342 | 600 |
| 1 | 25 | G.E. | MT356 | 400 |
| 1 | 20 | Triumph | C10 | 1200 |
| 2 | 15 | G.E. | MT302 | 1200 |
| 1 | 15 | G.E. | MT332 | 720 |
| 1 | 15 | G.E. | MT512 | 900 RPM |
| 1 | 15 | G.E. | MT586 | 280 |
| 3 | 10 | Westg. | CW464A | 1200 |
| 1 | 10 | Westg. | HF | 1140 |
| 6 | 2 | G.E. | MT926 slip ring | 1800 |

### DC—230 Volt

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 75 | Diehl | K11 | 550 |
| 1 | 100 | G.E. | CD123 | 1200 |
| 1 | 60 | Westg. 115v. | SK140L Vert. | 1140 |
| 1 | 60 | G.E. | EFI | 1200 |
| 1 | 40 | Rel. 440v. | 13LT Vert. | 1750 |
| 1 | 40 | Rel. 440v. | 230T Vert. | 1130 |
| 1 | 25/40 | C.W. 440v. | CMC-EH Vert. | 1150/1750 |
| 1 | 40 | Westg. | SK 123 | 1150 |
| 3 | 40 | G.E. | RC32 | 1100 |
| 8 | 40 | Westg. | SK 140 | 775 |
| 1 | 35 | Al. Ch. | | 1200 |
| 1 | 35 | G.E. | DLC 203 | 700 |
| 1 | 30 | EL. Dy. | 158 | 625 |
| 1 | 30 | Rel. 440v. | 131 T Vert. | 1150 |
| 4 | 30 | Reliance | 92 TF | 1750 |
| 1 | 27½ | G.E. | CVC 116 | 1750 |
| 7 | 25 | Westg. | SK 120 | 825 |
| 2 | 25 | Westg. | SK 103 | 1150 |
| 1 | 25 | Westg. | SK 90 | 1400 |
| 4 | 25 | Westg. | SK 100 L | 1150 |
| 1 | 30 | G.E. | RC 51B | 1150 |
| 1 | 25 | Westg. | SK 123 | 550/1100 |
| 1 | 25 | Al. Ch. | E 120 | 500/1500 |
| 1 | 25 | J. & L. | | 625 |
| 2 | 20 | Reliance | 131T | 1000 |
| 2 | 20 | Diehl | K914-A | 500/1500 |
| 1 | 20 | G.E. | RF12 | 250/1000 |
| 1 | 20 | Lincoln | FKW B.B. | 1800 |
| 6 | 20 | Cr. Wh. | CMC T.E.B.B. | 1750 |
| 1 | 20 | Cr. Wh. | CMC T.E.B.B. | 1150 |
| 1 | 20 | Westg. | SK93 | 1150 |
| 14 | 20 | Reliance | 92T | 1150 |
| 1 | 20 | Westg. | SK 120 T.E. | 1100 |
| 3 | 20 | Westg. | SK 100L | 900 |
| 1 | 20 | Watson | K | 850 |
| 3 | 20 | Reliance | 131T | 850 |
| 1 | 20 | G.E. | RC30 | 750 |
| 1 | 20 | Westg. | SK110L-115V | 750 |

### DC—230 Volt

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 4 | 20 | Westg. | SK110L | 750 |
| 1 | 20 | Cr. Wh. | CW-CMC | 600 |
| 1 | 20 | Westg. | SK-120 | 600 |
| 3 | 20 | Al. Ch. | K | 500/1000 |
| 2 | 15 | Westg. | SK63 | 1750 |
| 1 | 15 | Westg. | SK113 encl. | 1750 |
| 1 | 15 | Westg. | SK93 | 1150 |
| 4 | 15 | Westg. | SK83 | 1150 |
| 4 | 15 | Cr. Wh. | CW-CCM T.E. | 1150 |
| 1 | 15 | Westg. | SK70L | 1250 |
| 1 | 15 | G.E. | CD83 | 1150 |
| 1 | 15 | G.E. | RC10 | 1150 |
| 1 | 15 | G.E. | RC29 | 1150 |
| 4 | 15 | Westg. | SK93 | 850 |
| 4 | 15 | Reliance | 92TF | 850 |
| 4 | 15 | R. & M. | | 1000 |
| 1 | 15 | G.E. | CVC-115 | 925 |
| 6 | 15 | Westg. | SK90 Vert. | 825 |
| 1 | 15 | G.E. | RC29 | 750 |
| 6 | 15 | Westg. | SK110L | 675 |
| 1 | 15 | Al. Ch. | | 1075 |
| 8 | 15 | Reliance | 131T | 550 |
| 3 | 15 | Reliance | 92T | 850 1750 |
| 3 | 15 | Reliance | 92T | 850/1700 |
| 1 | 15 | Reliance | 66T | 800/1600 |
| 1 | 15 | Westg. | SK | 500/1500 |
| 2 | 15 | Westg. | SK110L | 400/1600 |
| 1 | 15 | Triumph | 32F | 300/600 |
| 1 | 15 | Triumph | | 225/900 |
| 1 | 12½ | Westg. | SK. | 750/1500 |
| 7 | 10 | Westg. | SK70 | 850 |
| 2 | 10 | G.E. | RC29 | 850 |
| 2 | 10 | Reliance | 66TF | 850 |
| 20 | 10 | Westg. | SK60L-SK60-Reliance 46TF | 1150 |
| 7 | 10 | Cr. Wh. | CM CHB T.E.B.B. | 1750 |
| 1 | 10 | G.E. | RF11 | 600/2400 |
| 3 | 10 | G.E. | RF10 | 600/1800 |
| 6 | 10 | Westg. | SK80L | 500/1500 |

### DC—230 Volt

| Qu. | HP | Make | Type | R.P.M. |
|---|---|---|---|---|
| 23 | 10 | Al. Ch. | | 500/1000 |
| 1 | 10 | G.E. | RF10 | 540/1200 |
| 2 | 10 | Kimble | BA324 new B.B. | 1750 |
| 1 | 10 | Westg. | SK91 | 250/1000 |
| 14 | 7½ | Westg. | SK33 | 1750 |
| 4 | 7½ | Westg. | SK60 | 850 |
| 20 | 5 | Westg. & G.E. | | 1750 |
| 20 | 5 | Westg. Rel. | | 1150 |
| 35 | 5 | Westg. | SK43 | 580 |
| 50 | 3½ | Westg. | SK33 | 850 |
| 50 | 3 | Westg. | CD925 | 1725 |
| 70 | 3 | Westg. | SK20 | 1550 |
| 60 | 1 | Westg. | SK & CD | 1150 |
| 50 | 2 | Westg. | SK20 | 850 |
| 40 | 1½ | Westg. | CD | 1150 |
| 30 | 1½ | Westg. | CD925 | 550/2200 |

36 New vertical TEFC BB 3 phase, 220/440 volt, 60 cycle, as follows:
1—G. E. 2 HP—1200 RPM—ty. K, Frame 225
1—Fairbanks Morse 3 HP, 1200 RPM, Type QZCU, Frame 254
1—Delco 3 HP 1200 RPM, Type C Frame 254
3—G. E. 3 HP—1200 RPM—ty. K Frame 254
1—General Electric, 5 HP, 1800 RPM, Type K Frame 254
8—General Electric, 7½ HP, 1200 RPM, Type K Frame 324
7—Delco, 7½ HP, 1200 RPM, Type C Frame 324
1—Howell, 7½ HP, 1200 RPM, Type K, Frame 324
2—Howell, 7½ HP, 1800 RPM, Type KV Frame 284
2—Delco 10 HP, 1200 RPM, Type C Frame 326
1—Delco 15 HP, 1200 RPM, Type CL Frame 365
6—G. E. 15 HP—1200 RPM—ty. K, Frame 365
2—Howell, 15 HP 1200 RPM, Type KV, Frame 365

1—150 KW Westinghouse, synchronous M-G set, 275 Volt DC, 4400 Volt AC, 3 ph., 60 cycle, 900 RPM, AC control and DC panel.

1—150 KW General Electric, M-G set, 250/275 Volt, DC—440 Volt AC—3 phase, 60 cycle, 900 RPM.

2—Ridgeway 100 KW. Synchronous M-G sets, 250 volt DC, 2300 volt AC, 3 ph., 60 cycle, 1200 RPM, AC controls and DC panel.

1—Burke 200 KW, synchronous M-G sets, 260 volts DC, 440 volts AC, 3 ph., 60 cycle, 900 RPM, with AC and DC controls.

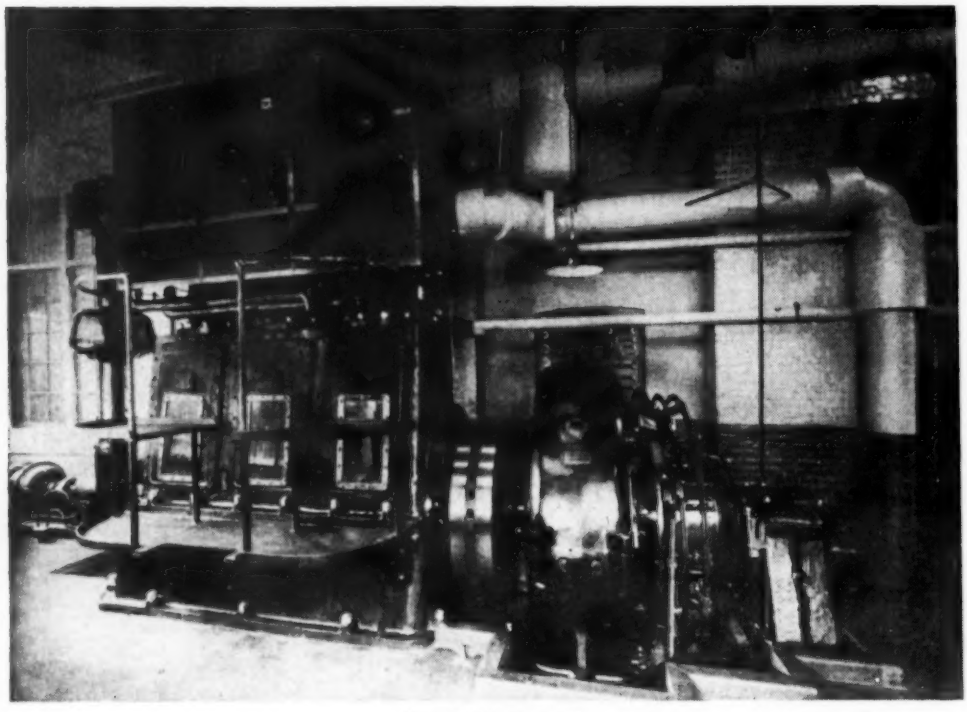
1—New G. E. 250 HP, ty. KF, fr. K 549A., 440 V., 3 Ph., 60 Cy., 3600 RPM vert. direct connected to Bingham, type 2, 22 stage double case, 3600 RPM, 3820 head, 175 GPM pump.

The Wente Electric Co.

Hamilton, Ohio

**Rebuilt Motors & Generators**
***SINCE 1906***

# 400 KW DIRECT CURRENT SKINNER UNAFLOW ENGINE GENERATOR UNIT



400 KW maximum—325 KW, 35°C. Crocker-Wheeler 125 volt, 300 RPM interpole direct current generator direct connected to a 15" x 14", 3 cylinder, 300 RPM Skinner vertical Unaflow non-condensing engine, 125 to 150 lbs. pressure, 0 to 5 lbs. gauge back, complete with switchboard.

*Excellent Condition*

*Complete Installation*

*Actual Photograph*

## TURBINE-GENERATOR UNITS
### 3 phase, 60 cycle

**2500 KVA Westinghouse condensing,** 180 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser, exciter.

**1875 KVA Westinghouse condensing,** 175 to 200 lbs. pressure, 500°TT, 480 volts, 3600 RPM, complete.

**750 KVA G.E. condensing,** 225 lbs. pressure, 2300 volts, 3600 RPM complete shaft exciter, surface condenser, switchboard.

**625 KVA G.E. condensing,** 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.

**625 KVA G.E. non-condensing** 150 lbs. pressure, 15 lb. back, 2300 volts, 3600 RPM complete exciter, switchboard.

**375 KVA G.E. condensing,** 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser.

**125 KVA Westinghouse non-condensing,** 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts, with exciter, switchboard.

**125 KVA G.E. non-condensing,** 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts. 3600 RPM complete.

**100 KVA Westinghouse non-condensing,** 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

## ENGINE-GENERATOR UNITS
### Alternating Current
### 3 phase, 60 cycle

**500 KVA Westinghouse,** 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure.

**312 KVA G.E.** 480 volts, 180 RPM generator direct connected to 24" x 20" Skinner Universal Unaflow engine, 175 to 200 lbs. pressure.

**300 KVA G. E.** 2300 volts, 150 RPM generator direct connected to 18" x 30" Murray Corliss engine, 110 to 150 lbs. pressure.

**225 KVA E.M.** 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

**200 KVA Crocker-Wheeler,** 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

**180 KVA G.E.** 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

**150 KVA G.E.** 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

**75 KVA Allis** 2300/550 or 440 volts, 257 RPM generator direct connected to 12" x 16" Chuse 4-valve non-releasing Corliss engine.

## ENGINE-GENERATOR UNITS
### Direct Current

**75 KW Westinghouse,** 125 volt, 1800 RPM non-condensing turbine generator unit.

**75 KW Allis-Chalmers Terry,** 125 volts, 2400 RPM non-condensing turbine generator unit.

**35 KW General Electric,** 125 volt, 3600 RPM non-condensing turbine-generator unit.

**15 KW Crocker-Wheeler,** 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

## SPECIAL BARGAIN OFFERINGS

**1200 KVA General Electric,** 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

**540 KW,** 180 volt, 3000 amperes, 1200 RPM Westinghouse direct current generator.

**500 KVA Westinghouse,** 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.

**GENERAL ELECTRIC MOTOR GENERATOR SET** consisting of:
150 HP, 3 phase, 60 cycle, 2200 volts, 1200 RPM alternating current motor direct connected to 100 KW, 800 amperes, 125 volt, 1200 RPM compound wound interpole direct current generator.

**GENERAL ELECTRIC MOTOR GENERATOR SET** consisting of:
75 HP, 115 volt, 1200 RPM shunt wound direct current motor direct connected to 62½ KVA, 3 phase, 60 cycle, 2300 volt, 1200 RPM alternating current generator.

**MANISTEE ROTARY JET CONDENSER** 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.

**10 TON CAPACITY BROWN HAND OPERATED TRAVELING CRANE** with 31'0" span including 150' of I-beams.

**1—ALLIS CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volts, 300 RPM A.C. motor.**

**Utilities Electrical Machinery Corporation**

600 NATIONAL CITY BANK BLDG
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

## 2500 KW EXTRACTION-CONDENSING UNIT

**480 volt, 3 ph. 60 cycle. Built for 175/185# 525° f.t.t. Extraction 58,000#/Hr. max. at 5# g. (1920) Turbine now being rebuilt; will arrange for extraction at 30# g. if required. Includes 35 KW MG exciter set—all switchgear, accessories, and auxiliaries.**

## 1500 KW G.E. CONDENSING UNIT

**150/250# initial—60/3/480 v. rewound**

**Surface Condenser—all auxiliaries—Complete—good condition—feed water extraction**

## 90,000#/Hr. 250 PSI B&W integral FURNACE BOILER—

**GAS and OIL fired. Never installed—can ship and install on short notice—all auxiliaries complete.**

## FURNACE TRANSFORMERS

**Two units 4000 KVA 60 cyc. 3φ 13,200 primary 239/85 secondary, oil insulated water cooled, with controls.**
**Two units 3000 KVA same specifications as above.**
**Two units 4000 KVA 60 cyc. 3φ 22,000 primary 230/100 secondary, with reactors and controls.**
**One 1500 KVA 3φ 12,000 primary and 3600 KVA bank 13,200 primary. Also several smaller units.**

## VERY GOOD EXTRACTION-CONDENSING MACHINE—CAN SHIP QUICK

**1000 KW—0.8 p.f.—250# 550° 25# g. extraction—60/3/480 11 stage turbine—double bucketed in high—13.5#/KWH condensing W.R.—direct connected exciter—surface condenser switchgear—Built 1929—mate duplicate installation—regular maintenance and renewals.**

## TRANSFORMER (OUTDOOR)

**10,000 KVA 3φ 60 cyc. OISC, 13,200 delta/4600 delta 4 taps 2½% below primary. Cannot be reconnected to other voltage.**

## STRAIGHT—CONDENSING TURBO SET 450# 650° WESTINGHOUSE

**1500 KW—0.8 p.f.—60/3/240—built 1928—surface condenser all auxiliaries—reported excellent physical condition.**

### TURBO ALTERNATORS

**Condensing**

**1000 KW** (3 units) 2400 V 150# 100° Jet Cond (new about 1922)
**1250 KW** 2400 V 200# 100° Surf Cond (new 1924)
**1500 KW** 480 V 200# 100° Jet Cond (new 1920)

**Non-Condensing**

**100 KW** 240 V 175# 100° ISP 0 to 5# g. BP (new 1921)
**1500 KW** 2400 V 175# 100° ISP 10# g. BP (new 1926) rebuilt
**1500 KW** 240 V 400# 650° ISP 90# g. BP (new 1928)
**1000 KW** 60/3/2400 200# ISP 5/10# g. BP Allis about 1920.
**2000 KW** 60/3/480 200# ISP 20# g. BP G.E. about 1921.

### DC TURBO UNITS

**1000 KW** 250 V 150# Surface Condenser
**750 KW** 250 V 16#/165# (M.P.) Jet Condenser
**150 KW** (2 units) 250 V 225# 25# g. BP modern design

### ENGINE GENERATORS
### 60 cycle 3 phase

**400 KW** 480 V Allis Corliss 175# 150° ISP 25# (new 1924) excellent unit
**400 KW** Chuse Unaflow 150# 60/3/2400 built about 1930

### DC ENGINE SETS

**200 KW** (3 units) 250 V DC Hamilton Corliss left hand
**250 KW** 1250 V DC Erie Ball built 1916 (2 units)

### BOILER PLANT

**300 HP** 200#—gas fired—water treatment—building—stacks—excellent

### TRANSFORMERS

**100 KVA** to 4000 KVA 33, 22, 13.2, 2.4 KV primaries

### BOILERS

**Water Tube**

**600 HP** (2 units) 160# pulverized firing—sect'l hdr. Pennsylvania
**400 HP** 400# 650" sect'l hdr (new 1928)
**519 HP** Heine Boiler—CAN SHIP INTACT. MOST MIDWEST POINTS—NOT NECESSARY REMOVE OR REPLACE TUBES. Built 1928 for 180# and now approved 180# Coxe chain grate stoker equipped.
**30,000#/hr.** B&W Integral Furnace Type, 425#, pulverized coal fired.
**40,000#/hr.** Riley—Gas and Oil Fired, 425#.

**Fire Tube**

**90 HP** 118# stoker equipped ASME Mich. Code HRT
**100 HP** Farrar & Trefts 150# hydrostatic test, stoker fired.
**250 HP** 125# grates and stack non-code Scotch Marine
**125 HP** (ten units) 300# Oil Country Boilers ASME Code
**400 HP**—2 units—Scotch Marine ASME Code—150#

**And a few modern 450-500-700 psi Generating Units**

### DIESEL ENGINE GENERATORS
### 60 cycle 3 phase

**400 KW/600 HP** 480 V Clark 2 cycle vertical 400 RPM
**650 HP/500 KW** Enterprise, factory rebuilt, 60/3/2400
**440 KW/650 HP**—2400 v. ENTERPRISE—rebuilt—guaranteed
**1500 KW**—Plant complete—Fairbanks-Morse—fair condition

### DIRECT CURRENT UNITS

**340 KW** (two units) 250 V. Nordberg 3 cyl. 2 cyc.
**525 H.P.** @ 257 RPM—Elliott Generator
Each unit complete. BUILT 1943. (Price is reasonable)

### POWER UNITS

**180 HP** Fairbanks Model 32E12 (new unit)
**225** Buckeye 6 cylinder 400 RPM complete (new 1941)

## SPECIAL

**A—250,000#/Hr. 450# pulverized coal fired steam generator—complete and in good condition.**
**B—100,000#/Hr. 700# stoker fired unit complete and in good condition.**

# PAUL STEWART & CO., INC.

**UNION TRUST BUILDING . . CINCINNATI 2, OHIO**

***Over 50 Years of Service***

# AVAILABLE FOR IMMEDIATE SHIPMENT

# AIR COMPRESSOR

*1—3,000 C.F.M., 125 lb. press. W N 4 Sullivan Air Compressor 500 H.P., 3-60-2200 V direct coupled motor, exciter, panel board, after cooler and air receiver.*

## UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM direct connected to 300 kw G.E. Alternator 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

## SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# ISP 0-5# BP direct connected to Burke Alternator 3-60-480 v. 200 RPM with Exciter and Control Panel.

## TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0-60# B.P.

## TURBO PUMP

1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B.P.

## CENTRIFUGAL PUMPS

3—400 GPM, 635' Ingersoll Rand direct connected to Wesghse 125 HP motor, 360-2200 v. 3600 RPM.

2—500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135 head, LeCourtney Centrifugal Pump, 1800 RPM.

1—1000 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—1200 GPM, 35' head American Well Works, 1750 RPM direct connected to 15 HP motor 3-60-220/440 v.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

1—2000 GPM 188' head Ingersoll Rand Centrifugal Pump, direct connected to 125 HP West. motor 3-60-2200 v., 1800 RPM with starter.

## CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

## GATE VALVES

STAINLESS STEEL
Flanged Sizes from 1" up to 6"

## NEW HOISTS

150 Yale & Towne 2 ton Chain Hoists. 20' lift. BRAND NEW in Original Packing.

## MOTORS

1—300 HP Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM.

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

7—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 HP, 220/440 Volt, 60 cycle, 3 phase, 1745 RPM, Philadelphia Gear, output 425 RPM.

## BUFFALO BLOWERS

10—Buffalo Steel Plate Blowers, 40", Type R. From 1,000 to 10,000 C.F.M., required H.P. from 6 to 28 H.P. for air at 70° F., 3.75 to 17.75 for air at 350° F. From 1,000 C.F.M. at 12" static pressure to 10,000 C.F.M. at 1.9" static pressure at 1750 R.P.M.

## 300 AND 400 AMPERE ELECTRIC MOTOR DRIVEN ARC WELDERS

*Lincoln—Hobart—General Electric*
Reconditioned—Guaranteed—New 1943

## MISCELLANEOUS

1—3600 sq. ft. CR. Wheeler Surface Condenser.

**Heat and Power Co., inc.**

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

# Delivery Today

## 2-2000 H.P. FAIRBANKS MORSE

LATEST MODEL 33 DIESEL ENGINES

Also complete generator plants 1875 KVA

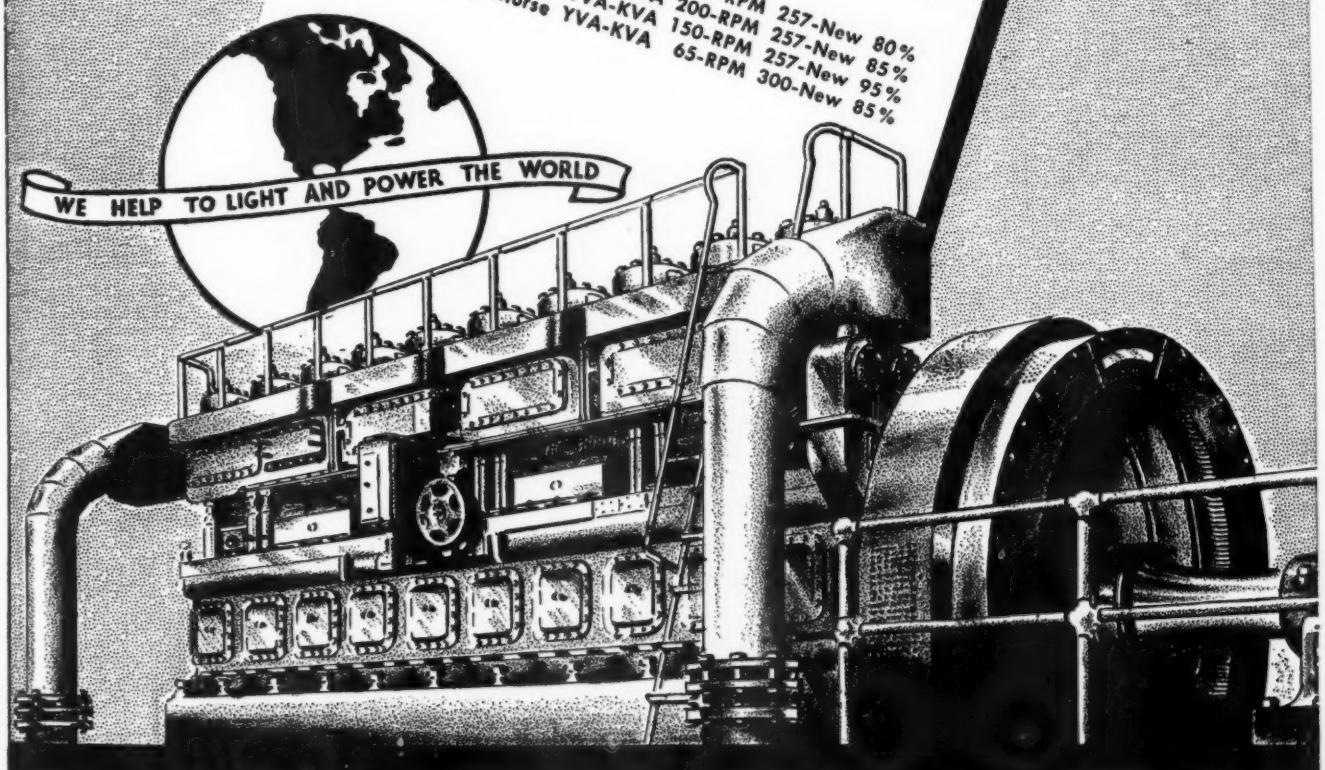
### OTHER IMPORTANT UNITS

1-840 HP-Fairbanks Morse M -KVA 565-RPM 257-New 99%
2-720 HP-Fairbanks Morse M -KVA 465-RPM 257-New 95%
2-600 HP-Fairbanks Morse 33F-KVA 500-RPM 400-New 99%
2-450 HP-Fairbanks Morse 33E-KVA 375-RPM 360-New 95%

### SPECIAL LOW PRICED OFFERINGS

These units, thoroughly inspected, represent low initial cost and low maintenance. They are particularly suited for emergency and standby service. Many organizations have obtained excellent results with units of this type, purchased from us.

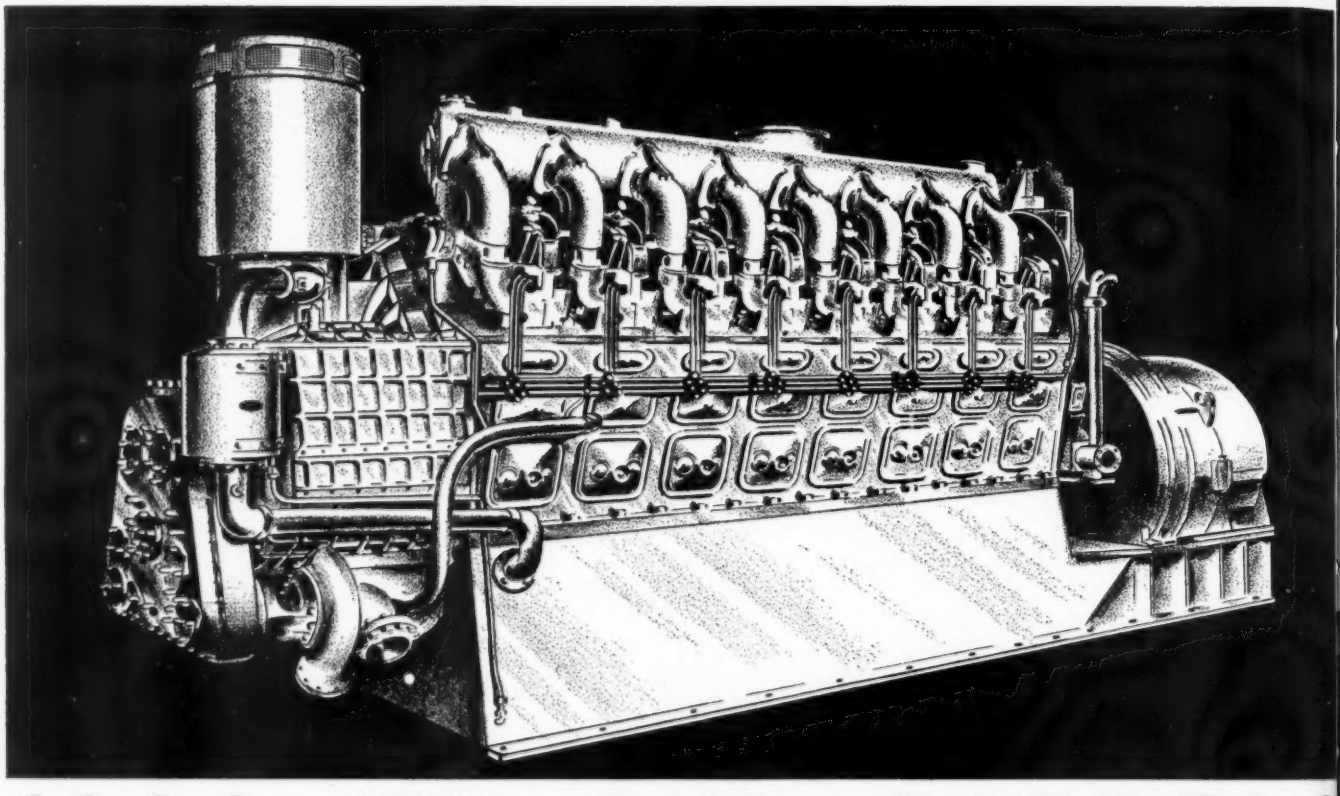
1-360 Fairbanks Morse YVA-KVA 300-RPM 257-New 80%
2-240 Fairbanks Morse YVA-KVA 200-RPM 257-New 85%
1-180 Fairbanks Morse YVA-KVA 150-RPM 257-New 95%
1- 80 Fairbanks Morse YVA-KVA 65-RPM 300-New 85%




## DIESEL MOTORS CORPORATION

PORT WASHINGTON, L.I., N.Y. TELEPHONE • ROSLYN 2000

# DEPENDABLE POWER.



# 1000 KW G.M. DIESELS

**1600 HP GENERAL MOTORS MODEL 16-278A ENGINES**
**16 CYLINDER—2 CYCLE—720·750 RPM DIRECT CONNECTED TO**
**50–60 CYCLE AC OR 525 VOLT DC GENERATORS**

## MANY OTHER IMPORTANT OFFERINGS

| KW | Model | RPM | New |
|---|---|---|---|
| 1 — 240 | McIntosh Seymour | 360 | 85% |
| 1 — 239 | Ingersol Rand S | 600 | 95% |
| 3 — 115 | Murphys ME 650 | 1200 | 90% |
| 3 — 60 | General Motors 6-71 | 1200 | 100% |
| 4 — 50 | International UD18 | 1400 | 100% |
| 1 — 50 | Cummins | 1200 | 100% |
| 4 — 30 | International UD14 | 1350 | 100% |
| 1 — 30 | General Motors 371 | 1200 | 97% |
| 20 — 15 | International UD6 | 1500 | 100% |
| 2 — 35 & 25 | Buda | 900 | 90% |

**Other units new and rebuilt.**

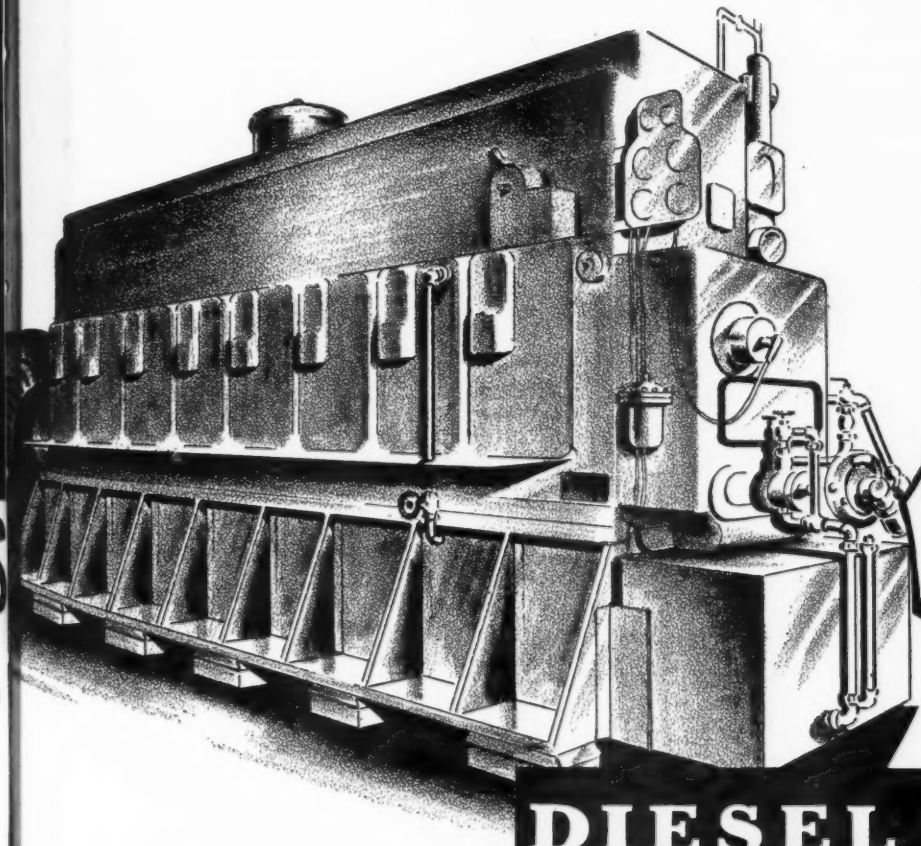
# ..at low cost

## NEW BUCKEYE DIESELS

225-300-450 HP • MODEL 80 • 4-5-8 CYLINDER 10½ x 12 • 2 CYCLE • 600 RPM

ALSO COMPLETE GENERATOR PLANTS

150-200-300 KW

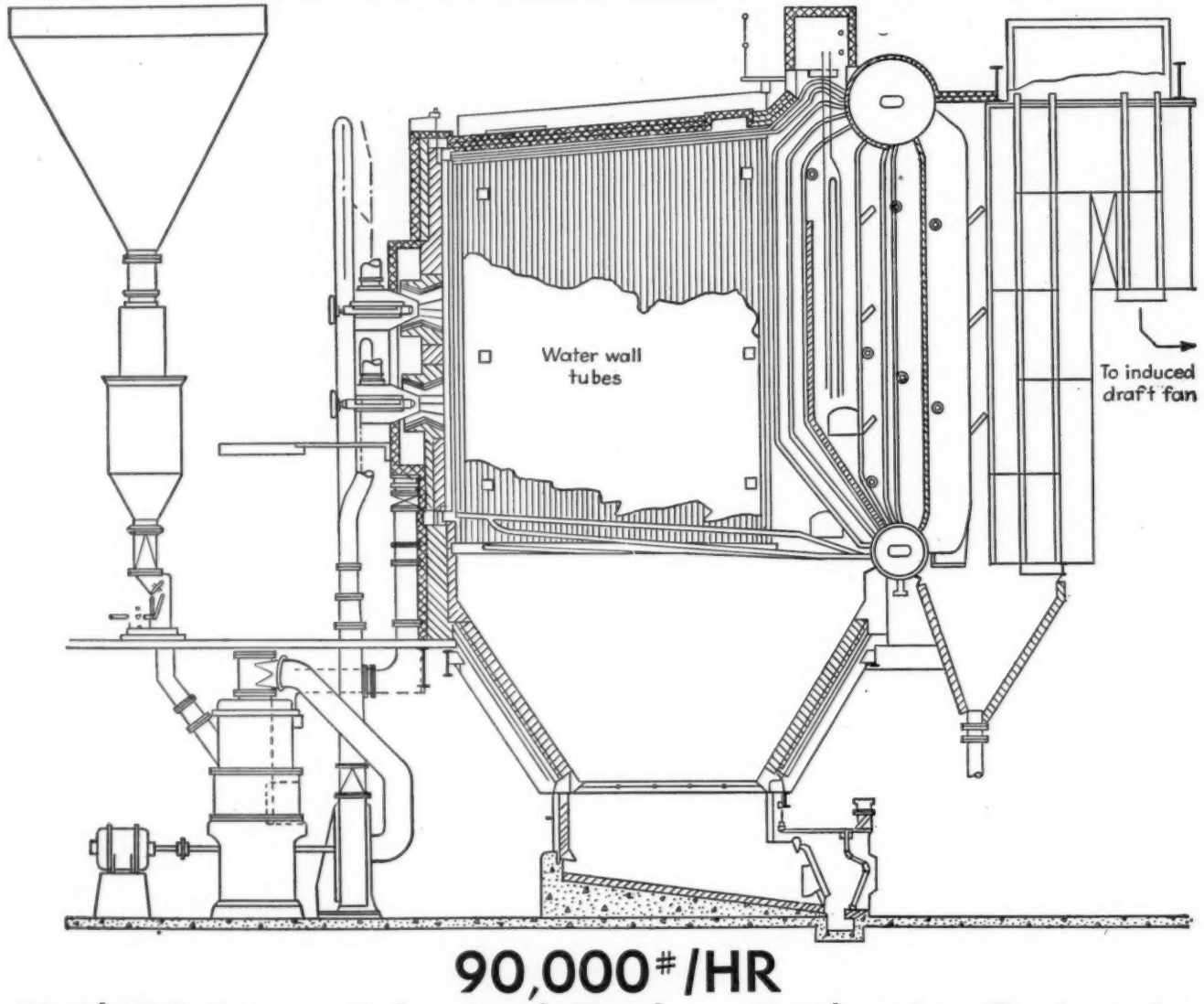


IMMEDIATE DELIVERY!

DIESEL MOTORS CORPORATION

PORT WASHINGTON, L. I., N. Y.
TELEPHONE • ROSLYN 2000

WE HELP TO LIGHT AND POWER THE WORLD




# 90,000#/HR

## 550/600 Psi Pulverized Fired Combustion Engineering

7—Diamond Flow Blowers; 2—Raymond Pulverizers;
4—C. E. Burners; Water Columns; 2—Raymond Coal Scales and Feeders; full load oil firing

**Main Header** ..... 18" with 4 automatic electrically operated valves controlled from boiler panel

**Draft Fans** ..... Forced and Induced turbine driven

**Control System** ..... Smoot control, 3 panels, with starter for pulverizer, Bristol recording meter, water gauges, draft gauges, etc.

**Unit built and installed 1940** Designed for 600#—Boiler heating surface, 10,599 sq. ft.; Water wall surface 2,699 sq. ft.; C. E. Tubular air heater Type VU; Elesco superheaters for 700/750°F. T.T.; for operation on feedwater of 298°F.
Efficiency overall—approximately 85%.

**Mill Capacity** ..... 7400# coal/hour each—(coal 13% moisture, grindability 50/70 Hardgrove—crushed to ¾ in. through VSS 200 screen)

**Capacity** ..... 90,000#/hr., 550 psi; 690°F., with coal of grindability 50 crushed to ¾" round, moisture 13% max., BTU 11,000, Ash softening 1950°F.

**Also—Water Treatment Plant** 2 units separable—total of 1560 GPM—Sodium ZeoKarb System—with precipitators, consisting of
2—Steel tank Spaulding precipitators—780 GPM ea.
5—Steel filters—gravity type 1250 GPM (315 GPM ea.)
5—ZeoKarb Na softeners—1020 GPM; each to remove 2035 kilograms of hardness between regenerations.

**Also—Coal Handling System.** 100 Ton/Hr.—560 Ft. Link Belt with supporting structure—Belt unloader—Coal Yard drag—crushers—screens.

## THOMAS ROME and ASSOCIATES, Inc.

307 E. FOURTH ST. CINCINNATI 2, OHIO

# GLOW

### SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

### MOTOR DRIVEN CENTRIFUGAL PUMP

**Dayton Dowd, size 6x18 CSLF, rated 7250 G.P.M. 30 ft. head, at 685 RPM Centrifugal Pump mounted on common base and driven by:—**
**Continental 75 HP. 695 RPM, 220 volt, 3 phase, 60 cycle, drip proof motor.**

### COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

*Note: Designed to be operated in series or parallel for higher voltage or current.*

### NEW DIRECT CURRENT MOTORS

25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

### A. C. GENERATORS

(3 phase unless otherwise noted)

| KW | P.F. | RPM | Volts | Description |
|---|---|---|---|---|
| 3 | 1 | 1200 | 120 | Hobart, Ball Bearing |
| 4 | 1 | 1170 | 440 | Westinghouse, Single Phase |
| 7½ | .6 | 1800 | 440 | Electric Specialty, Ball Bearing |
| 15 | 1 | 1800 | 127/220 | General Electric, Single Bearing |
| 20 | .8 | 1800 | 1100 | Fairbanks-Morse |
| 20 | 1 | 1800 | 110 | Ft. Wayne, Single Phase |
| 25 | .8 | 1200 | 208/120 | Westinghouse, Ball Bearing, New |
| 30 | .8 | 1200 | 120/208 | Delco |
| 40 | 8 | 1200 | 220 | Burke, Single Bearing |
| 50 | .8 | 1200 | 120/208 | Electric Machinery, Single Bearing, 4 Wire |
| 87½ | .8 | 900 | 110/220 | Starr, Single Phase |
| 100 | .8 | 900 | 200 | Crocker-Wheeler |
| 100 | 1 | 900 | 2300 | General Electric |
| 120 | .8 | 257 | 2300 | General Electric, Single Bearing |
| 150 | 1 | 600 | 480 | Burke |
| 150 | .8 | 900 | 600 | General Electric |
| 150 | .8 | 600 | 480 | Crocker-Wheeler |

### AIR COOLED TRANSFORMERS

General Electric, 30 KVA, 460 volts primary, 230/115 volts secondary, 1 phase, 60 cycles.

General Electric, 35 KVA, 460 volts primary, 230/115 volts secondary, 1 phase, 60 cycles.

### PLATING GENERATORS

Jantz & Leist, type IP, 4000 ampere, 2 to 12 volts, 425 RPM, direct current Plating Generators with or without driving motors.

### GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

*Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.*

### GEAR HEAD MOTORS

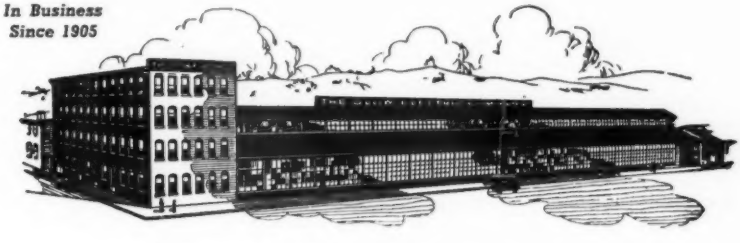
New Master, ¼ HP, 1725 RPM, 115/220 Volts, 1 phase, 60 cycle, output shaft speed 280 RPM, for vertical mounting.

General Electric, ¾ HP, 1750 RPM, 220/440 Volts, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RPM, right angle worm gear.

Master, 10 HP, 1730 RPM, 220/440 Volts, 3 phase, 60 cycle, vertical, gear head motor, tripod legs, output speed 450 RPM.

General Electric, 50 HP, 1760 RPM, 220/440 Volts, 3 phase, 60 cycle, vertical gear head motor, output speed 586 RPM.

*In Business Since 1905*



# ELECTRIC CO.

### Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Hendy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

### DYNAMOMETERS

General Electric, 50 HP, 700/2500 RPM, 250 volt, 21.008 inch torque arm. Can absorb up to 60 HP motor.

### WELDER SETS

| Amps. | Voltage | Manufacturers | Driven By |
|---|---|---|---|
| 100 | 25 | Lincoln | 5 HP, 220 volt, 3 ph. 60 cy. |
| 150 | 70 | Arc Weld Mach. Co. | No Motor |
| 150 | 45/35 | Wilson Plastic Arc | 7½ HP, 230 volt, Direct Current |
| 150 | 25 | Imperial | No Motor |
| 150 | 6 arc capacity | Arc Weld Mach. Co. | 30 HP, 220 volt, 3 ph. 60 cy. |
| 175 | 55/25 | Westinghouse | 7½ HP, 220/440 V., 3 ph. 60 cy. |
| 200 | 60/20 | General Electric | 1800 RPM—No Motor |
| 200 | 60 | Todd | 7½ HP, 220 volt, 3ph. 60 cy. |
| 200 | 40 | Lincoln | 10 HP, 220 volt, 3 ph. 60 cy. |
| 300 | 25 | Westinghouse | 15 HP, 230 volt, Direct Current Motor |
| 300 | 40 | Wilson, single bearing for direct connection at 1800 RPM | |
| 300 | 40 | Lincoln | 20 HP, 440 volt, 3 ph. 60 cy. |
| 300 | 40 | Lincoln, single bearing for direct connection at 1400 RPM | |
| 300 | 40 | Ideal | 20 HP, 220 volt, 3 ph. 60 cy. |
| 400 | 20 | Wilson | No Motor |
| 400 | 40 | Lincoln | 25 HP, 220 volt, 3 ph. 60 cy. |
| 500 | 60 | Westinghouse | 45 HP, 220 volt, 3 ph. 60 cy. |
| 1000 | 30 | Westinghouse | 50 HP, 220 volt, 3 ph. 60 cy. |
| 1000 | 60 | Westinghouse | 92 HP, 220/440 V., 3 ph. 60 cy. |
| 1500 | 60/60 | Century | 135 HP, 440 volt, 3 ph. 60 cy. |

**The items listed above are only a partial list of the large stock of electrical equipment which is available to meet your requirements.**

**AC & DC MOTORS • GENERATORS • PUMPS**
**SYNCHRONOUS MOTORS • CONTROL EQUIPMENT**
**MOTOR GENERATOR SETS • ELECTRIC HOISTS**
**STEAM ENGINE GEN. SETS • SLIP RING MOTORS**

**933-943 HARRIET ST.**
**PHONE MA. 3024**
**CINCINNATI 3, OHIO**

ENGINEERED AGSCO DIESEL POWER

*A typical diesel power plant engineered by AGSCO.*

AGSCO POWER DEPENDABILITY ENGINEERING

**POWER**

As leaders in the power field for many years, AGSCO has served industry and municipalities with Diesel Plants in total capacities from 100 to 12,000 KW. We have served the power requirements of industrial and municipal plants in the last 12 months with a total of more than 150,000 horsepower.

**DEPENDABILITY**

AGSCO affords all power users the opportunity to install extremely desirable diesel power equipment. Prompt deliveries of industrial Diesel Power are supplemented by a written guarantee of satisfactory electrical and mechanical operation.

**ENGINEERING**

Our Engineering Department analyzes all installations and problems such as paralleling and criticals.

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

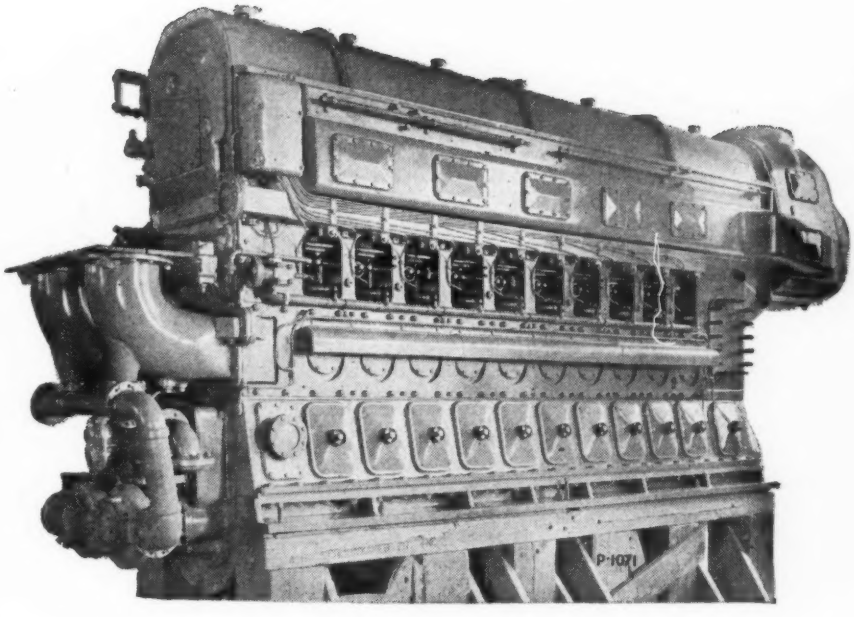
50 CHURCH STREET NEW YORK 7, NEW YORK

*Cable Address:* AGSCOMACH PHONE: WOrth 2-7225

Business Est. 1898

DIESEL POWER

ENGINEERED AGSCO DIESEL POWER



*3000 KVA PLANT*

*CONSISTING OF:*

3—1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8⅛, 10 cylinder, 8⅛" bore 10" stroke, 600 RPM.

These three units are offered with complete equipment — switchboards, auxiliaries cooling equipment and silencing equipment.

## DIESEL GENERATORS

## ALTERNATING CURRENT

| KVA | MAKE | HP | MODEL | RPM | YEAR |
|---|---|---|---|---|---|
| 2—1875 | Fairbanks Morse | 2000 | 33E16 | 300 | 1939 |
| 1—1250 | Nelseco | 1500 | 6MI-63 | 300 | 1931 |
| 4—1250 | Fairbanks Morse | 1700 | 38D8⅓ | 720 | 1944 |
| 12—1250 | General Motors | 1600 | 16-278-A | 720 | 1944 |
| 3—1000 | Fairbanks Morse | 1250 | 38D8⅓ | 600 | 1944 |
| 1— 625 | Superior | 750 | OS | 327 | 1938 |
| 1— 312 | Enterprise | 450 | D8G-8 | 450 | New |
| 1— 300 | Fairbanks Morse | 360 | YVA | 257 | 1928 |
| 1— 250 | General Motors | 300 | 8-268-A | 900 | New |
| 4— 250 | General Motors | 400 | 8-268-A | 1200 | 1945 |
| 6— 125 | General Motors | 200 | 3-268-A | 1200 | 1944 |
| 1— 94 | Buckeye | 112 | E | 400 | 1936 |

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: WOrth 2-7225

Business Est. 1898

DIESEL POWER

# LIQUIDATION SALE

## (MOST EQUIPMENT 3 TO 4 YEARS OLD)

### DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl. 2 cycle 5"x6" 1200 RPM (built 1936)

2—350 H.P. Superior Diesel Ser #10501 & 10529, Type VD. MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 4 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

### DIESEL GENERATORS

4—1200 KW, D.C., Allis Chalmers, 525 V. 750 RPM Driven 1700 HP General Motors Diesel 16-278A 750 RMP (New 1943)

2—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½" x 7" 2 cycle, 1200 RPM (new 1943)

3—60 KW, DC, 225 V driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½' x 5" 1200 RPM. New 1943

2—20 KW, DC, 250 V, driven by 30 H.P. General Motors Diesel, 2-71, 2 cylinder, 4½" x 5" 1200 RPM. New 1943

2—60 KW, DC, Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished.

### MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

**18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM**

**28—DC 1500 HP, W'hse, 525 V, 600 RPM**

### HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC

5—Mead Morrison Co., single drum derrick swingers type 138, driven by 5 HP G.E. motor 230 V, DC

NOTE: The above hoists are complete with controllers

2—Jaeger Utility hoists, single drum, driven by Continental 6 cylinder gasoline engine.

### TURBO-GENERATORS

**6—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.**

**6—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.**

8—200 KW G E type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V. D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

### MOTOR—GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

**GENERATORS**

**28—1200 KW DC Allis Chalmers, 525 V, 750 RPM**

### TURBO-BLOWERS

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

4—7800 Square Feet—¾" brass tubes, two pas. (new).

10—3800 Square Feet ⅝" copper-nickel tubes (new).

### SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc

### TRANSFORMERS

5—50 KVA 3—10 KVA
15—25 KVA 5— 3 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

### BOILER

6—Express, Boilers, modied D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

6—Wickes Boiler 628 H.P. 3 drum, Navy Types, 250 pounds pressure.

2—Cyclotherm 3000 pounds steam per hour.

### BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# d'schge., 3500 RPM, steam 240#

5—Ing. Rand 165 GPM 575# dischge., 4650 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

### CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze motor and turbine driven.

### RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel

### CENTRIFUGES

15—Sharples
15—DeLaval
Oil purifiers and oil clarifiers capacity 100 GPH and 150 GPH, with motors and pump

### HIGH PRESSURE AIR COMPRESSORS

2—Ingersoll Rand type 40, 4 stage, 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press, 7½ cu. ft., driven by G.E. 3/60/440 motors, 24 HP.

### DISTILLING PLANTS

2—Griscom Russell Sc'oshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Ingersoll Rand 40,000 gallons per day, triple effect, low pressure.

1—Condenser Service 80 tons per day, double effect

### FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P with AC and DC motors.

### FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.
1—Griscom Russell, 4 sect., 6 fin.

### FEED WATER HEATERS

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

Motors for Blowers also sold separately

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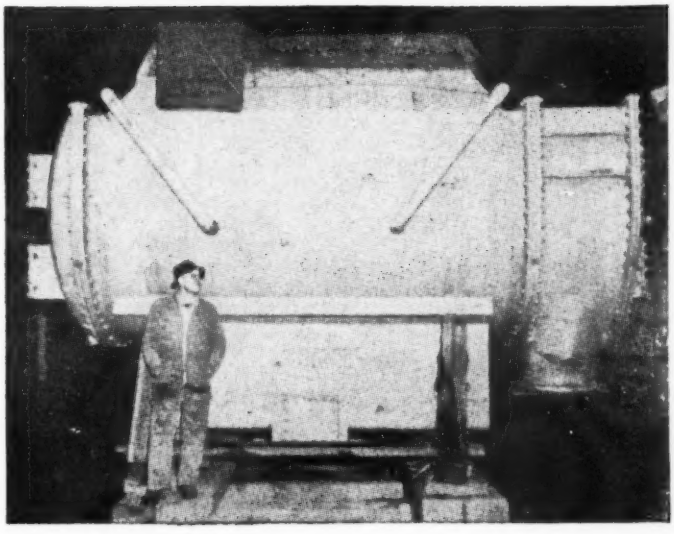
**Surface Type: Capacity 8280-sq. ft. Modern Laning**
**See Illustrations and Description Below: *Ask For Prices***



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**Steam Air Ejector**

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**Circulating Water Pumps**

**ALSO NEW**

**5000-KVA., G.E., 450#-isp., 2300-v Condensing Turbo-Generator Never Used: New Surface Condenser**

**4600-KW., G.E., 450-isp. Condensing: Surface Condenser Used 30 Days only - Same as New**

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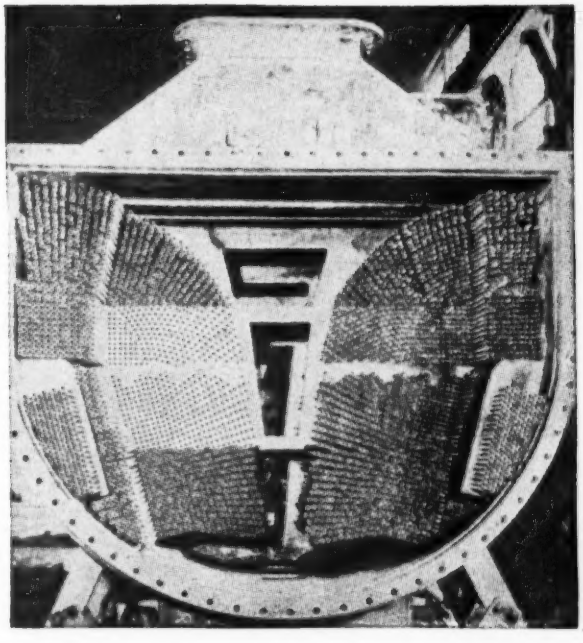

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### TURBINE UNITS—60 Cy.

1—25000 KVA General Electric Cond.
2— 6250 KW Gen. Elec. Cond. 25 Cycle
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
2— 3750 KVA Westinghouse Cond.
1— 3750 KVA Westinghouse Extrac.
1— 3125 KVA General Electric Cond.
2— 3125 KVA General Electric Extrac.
1— 1563 KVA Westinghouse Extrac.
2— 1250 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 225 KVA General Electric Non-C.
1— 125 KVA Westinghouse Non-C.

### STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Ames Uniflow
1—150 KVA Harrisburg 4-valve

### D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—150 KW Ridgway 4-valve, 125/250 V.

### DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V., 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
2— 250 HP Gen. Motors, 460 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM eng. only
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

### WATER TUBE BOILERS

2— 1409 HP, B.&W., 650-lb., Stokers
2— 748 HP EdgeMoor 250-lb., Stokers
2— 560 HP Erie City 460-lb.
1— 519 HP Titusville 200-lb., Stoker
5— 492 HP Heine 180-lb., Stokers
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

### SYNCHRONOUS MOTORS

4—6000 HP G. E. 60 cy. 2300 V. 90 RPM
1— 400 HP Al. Ch. 60 cy. 2300 V. 514 RPM
1— 300 HP G. E. 60 cy. 2200 V. 600 RPM 3-bearing
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 2300 V. 900 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

### INDUCTION MOTORS—60 Cy.

1—1000 HP West. S/R. 2200 V. 360 RPM
1— 800 HP G. E. S/R, 2200 V. 450 RPM
1— 500 HP G. E. S/R 2200 V. 3600 RPM
3— 150 HP Cr. Wh. S/C, B.B., 1200 RPM, 440 V.
2— 150 HP G. E. 440 V., S/C, 600 RPM
1— 150 HP G. E. 2300 V. S/C, 1800 RPM
2— 120 HP G. E. S/C, 220 V. 3600 RPM
1— 60 HP West. 2200 V. 1200 RPM

### MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
2— 225 KW Gen. Elec. 115 V. DC, 60 cy.
2— 125 KW Westinghouse 115 V. DC, 60 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.

### ROTARIES—60 Cy.

1—2300 KW Allis Chalmers 600 V.
2—1500 KW Westinghouse 250 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.
4— 500 KW Westinghouse 275 V.

### FREQUENCY CHANGERS

1—3125 KVA G. E. 25/60 cy. 300 RPM
1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1200 KVA G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1030 KVA Al. Ch. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

### TRANSFORMERS—1 Ph. 60 Cy.

2— 2000 KVA West. 69/34.5-4.8/2.4 KV
4— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
1—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 1030 KVA West. 26400-4150 V.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
2—10000 KVA Pitts. 13200-4600 V. 3 ph.
4— 2500 KVA G. E. 13200/22800Y—2300 V.
2— 1000 KVA G. E. 11500/23000-575 V.
3— 400 KVA G. E. 11500-2300 V. 1 ph.
3— 15 KVA West. 440-220/110 V.

### OIL CIRCUIT BREAKERS

| | | |
|---|---|---|
| 2— | 400 A. 25 KV G. E. FKO136 | Outdoor |
| 2— | 1000 A. 23 KV Kelman CB76 | Outdoor |
| 4— | 600 A. 15 KV G. E. FHKO139-24BS | Outdoor |
| 1— | 600 A. 15 KV G. E. FKO37 | Pole type |
| 2— | 400 A. 15 KV, G. E. FHKO136 | Outdoor |

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*Special Offerings*

### TURBO-GENERATORS

1—10,000 KW 11,000V Cond.
3— 3,000 KW 600 V Cond.
1— 2000 KW 600 V Cond.
1—2000 KW 480 V N.C.
2— 1500 KW 2300 V Cond.
1— 1250 KW 2300 V. Cond.
1— 1000 KW 440 V. Extrac.
1— 1000 KW 2300 V Cond.
1— 750 KW 240 V Extrac.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC, N.C.

### ENGINE GENERATORS

2—600 KW. 2300 V. Uniflow
1—168 KW. 600 V.
1—280 KW. 480 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V.D.C. Uniflow

### TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

### BOILERS

1—90,000# 550 PSI
1—50,000# 250 PSI
1—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW

### AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1—5000 CFM 10# G. Rotary Type Driven by 440V. Syn. Motor.

### TRANSFORMERS

3—200 KVA 600/220/110
2—2500 KVA 13800/2400/4150

### MOTOR GENERATORS

1—100 KW 550/125V

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**A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.**

The Buyer Must Be Satisfied—Always

### SYNCH. CONVERTERS

300 KW G. E. 600 D.C. 2300/4000 A.C. 1200 RPM. 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.

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300 KW RIDGWAY SYN. 250 V. 2200 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.
150 KW RIDGWAY SYN. 250 V. 2200 A.C. 900 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.
150 KW G. E. SYN. 600 V. 2300/4000 A. C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

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50, 75, 100, 150, 200 HP Slip Ring Motors
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1/3 & 1/4 HP Capacitor Type Motors
210 KVA G.E. Gen. D/C Skinner Unaflow
Portable Conveyors or Unloaders
18" or 24" Wide—any length
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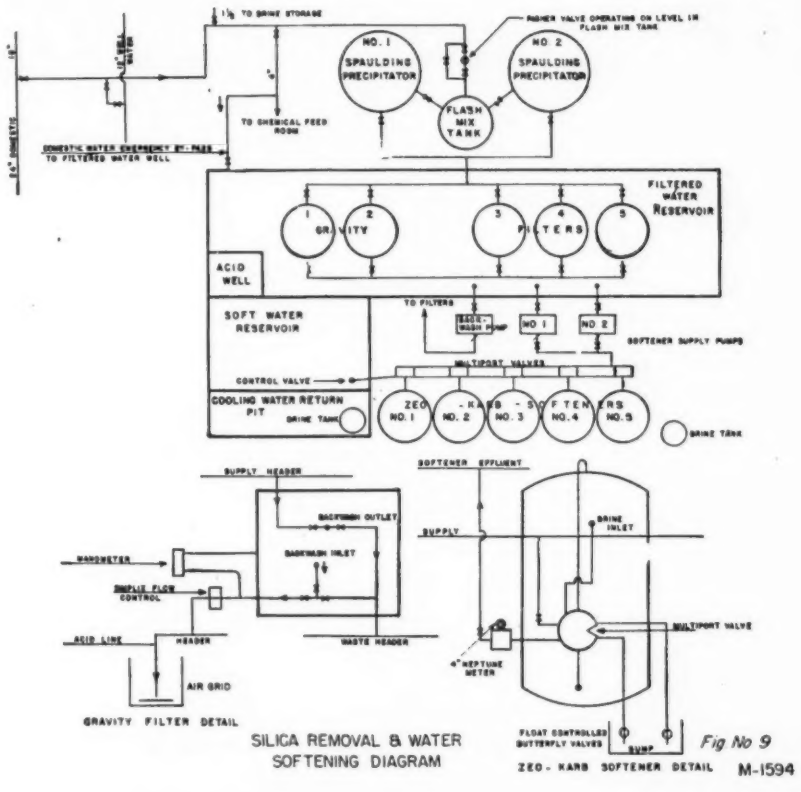


SILICA REMOVAL & WATER SOFTENING DIAGRAM

*Fig No 9*

M-1594

# Water Treatment Plant—Modern—Available—Now

Designed for 1560 GPM with water of 11 grains, total hardness calculated as $CACO_3$.
Used for boiler plant—Boiler feed requirements..1080 GPM
—Boiler blowoff waste..... 144 GPM
—Precipitator, etc., waste.... 336 GPM

1560 GPM

*Each softener to remove 2035 Kilograins of hardness between regenerations with water of 11 grains total hardness.*

## *Including:*

(A) Bailey indicating, integrating, and recording meter
(B) 10" Fisher pilotoperated flood valve
(C) 11' x 22' steel mixtank, motor driven agitator
(D) Ferrisul feed, electro-chemical control; two 5' x 5' lead lined steel tanks with agitators; 10' x 6' rubber lined feed tank and agitator, with pumps
(E) Spare electro-chemical control unit
(F) Lime feed, 10' x 6' chemical feed tank with agitator, pumps, electro-chemical control
(G) Dissolving lime tank 10' x 6' with agitator
(H) Two 39' x 22' high all steel Spaulding Precipitators with agitators
(I) Two Leeds & Northrup pH recorders
(J) Five gravity filters, 1575 GPM total, 315 GPM each—13' x 12' high, including graded anthrafilt
(K) Constant rate acid feed with Leeds & Northrup pH recorder and control, 2' x 2' lead lined acid tank, 7' x 5' high lead lined solution tank, orifice tanks, pumps, agitator
(L) Five sodium Zeo-Karb softeners 8' x 12' high with salt measuring tanks
(M) With miscellaneous pumps, motors, piping, chemicals, etc.

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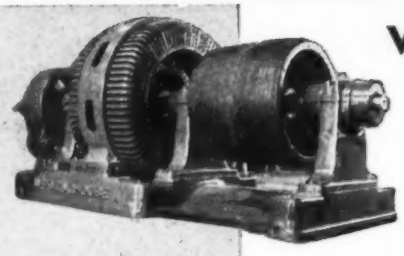

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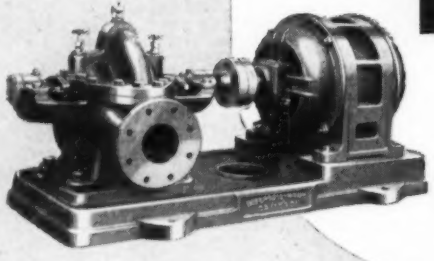

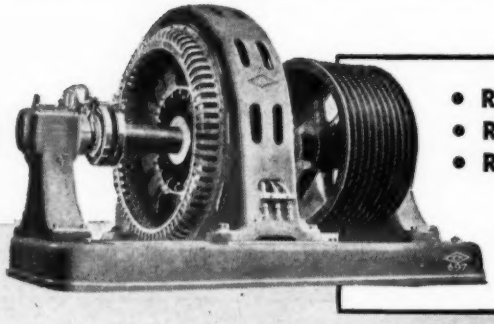

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- REPAIRING
- REWINDING
- BUYING
- SELLING
- RENTAL

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**us if you don't see the item you need. This listing is only a part of our large stock.**

### M-G SETS

**Others available—special units built to order.**

225 KW G.E. MPC gen. DC 125 V. coupled to 350 HP Whse. synch. motor 3/60/440 V. 900 RPM.
150—KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
75 KW Cr. Wheeler 65 H gen. DC 125 V. coupled to 100 KVA synch. motor 3/60/440 V.
60 KW G.E. C.D. gen. DC 60 V. 1000 amp. coupled to 90 HP synch. motor 3/60/220/440 V.
37½" KVA. Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. 8K motor DC 230 V. 1150 RPM. 3 brg.
2—40 KW Whse. like new. DC 250 V. output. AC motor 3/60/220/440 V.

### D. C. MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 125 | Cr. Wheeler | 125H | 230 | 500 |
| 100/150 | G.E. dynamon. | TLC | 250 | 1000/3500 |
| 75 | Whse. | 8436 | 125 | 475 |
| 65 | G.E. Northern | C | 230 | 375/750 |
| 60 | Diehl dynamon. | R10 | 250 | 500/2000 |
| 60 | G.E. b.b. | CDM103 | 230 | 1750 |
| 50 | Burke | | 230 | 350/1000 |
| 50 | G.E. Sprague | 1C | 250 | 700 |
| 50 | Cr. Wheeler | 50H | 230 | 700 |
| 40 | Allis Ch. | E120 | 230 | 1150 |
| 40 | Roth | S | 115 | 850 |
| 35/50 | Gen. Elec. | CD123 | 230 | 575/1150 |
| 25 | Gen. Elec. | DLC | 115 | 750 |
| 25 | Roth | elevator | 230 | 725 |
| 25 | Whse. enclosed | 8K | 230 | 600 |
| 25 | G.E. b.b. New | CD93 | 115 | 1150 |
| 20 | G.E. b.b. New(2) | CD83 | 115 | 1750 |
| 20 | Reliance | T | 230 | 850 |
| 20 | Imperial Int. dty. | D37 | 230 | 1200 |
| 20 | Gen. Elec. | 1C | 230 | 575 |
| 20 | Gen. Elec. | DLC | 230 | 500/1500 |

### SLIP RING MOTORS

**3 Phase, 60 Cycle, 220 or 440 Volts**

| Qu. | H.P. | Mfg. | Type | Speed |
|---|---|---|---|---|
| 1 | 400 | Gen. Elec. 3 brg. | I-P | 450 |
| 1 | 300 | Whse. | HF | 400 |
| 1 | 300 | Burke | EMV | 225 |
| 1 | 250 | Whse. | CW | 450 |
| 1 | 200 | Gen. Elec. | I-M | 1800 |
| 1 | 200 | G.E. 2200 v. | I-M | 360 |
| 1 | 200 | Whse. 3 brg. | HF | 600 |
| 1 | 75 | G.E. 2200 v. | I-M | 1800 |
| 1 | 60 | Ideal 2200/4000 v. | A | 1800 |
| 1 | 50 | Gen. Elec. | I-M | 600 |
| 1 | 50 | Gen. Elec. | MT336 | 1200 |
| 1 | 40 | Gen. Elec. | M546 | 514 |
| 2 | 40 | Allis Ch. | ANY | 450 |
| 2 | 37 | G.E. int. duty | ITC | 1200 |
| 1 | 37 | G.E. int. duty | ITC | 600 |
| 1 | 35 | Lancashire b.b. | late | 1800 |
| 1 | 30 | Gen. Elec. | MT346 | 600 |
| 2 | 30 | Gen. Elec. | OMT 336 | 1200 |
| 1 | 25 | G.E. int. duty | ITC | 1200 |
| 1 | 25 | G.E. 2200 v. | I-M | 900 |
| 1 | 25 | Gen. Elec. | I-M | 600 |
| 1 | 25 | Triumph | SR | 1200 |
| 1 | 25 | Gen. Elec. | MT326 | 900 |
| 1 | 15 | Watson | KHV | 720 |
| 4 | 10 | Century New b.b. | SRT326 | 1200 |

### SYNCHRONOUS MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 225 | KVA Gen. Elec. | ATI | 220/440 | 900 |
| 200 | Elec. Machy. | | 220/440 | 600 |
| 150 | Whse. | | 220/440 | 600 |
| 100 | KVA Cr. Wheeler | | 220/440 | 900 |

**Special—Two 50 H.P. Gearhead Motors—Howell bb 2 speed 1800/900 RPM 3/60/440 V. attached to D. O. James spur gear reducer, output 158/79 RPM, like new.**

* * * *

***Also many speed reducers and gear motors in stock up to 15 H.P.***

### CENTRIFUGAL PUMPS

**8" Alberger, 2000 gpm @ 80 ft.**
**6" Platt, 1000 gpm 230 ft.**
**8" Worthington, 2000 gpm @ 200 ft.**

### SQUIRREL CAGE MOTORS

**3 Phase, 60 Cycle, 220 or 440 Volts**

| Qu. | H.P. | Mfr. | Type | Speed |
|---|---|---|---|---|
| 1 | 125 | Northwn. | H | 1800 |
| 1 | 60 | Ideal | A | 1200 |
| 2 | 50 | Louis Allis New b.b. | OA | 1800 |
| 1 | 50 | Whse. | CCL | 900 |
| 1 | 50 | Gen. Elec. | I-K | 720 |
| 2 | 35 | Gen. Elec. | I-K | 720 |
| 2 | 30 | Howell b.b. 4 spd. | SC | 1800 |
| 1 | 20 | F. Morse | BH | 900 |
| 2 | 20 | Whse. New b.b. | CS364 | 1800 |
| 2 | 50 | Whse. 2200 v. vert. | CS | 900 |
| 1 | 40 | Gen. Elec. | I-K | 900 |
| 1 | 40 | Allis Ch. 3 spd. | ARX | 900/600/450 |
| 1 | 40 | Whse. | CCL | 720 |
| 1 | 40 | Gen. Elec. | I-K | 1200 |
| 1 | 30 | F. Morse | BH | 600 |
| 1 | 30 | Whse. | CCL | 600 |
| 2 | 25 | Allis Ch. | AN | 900 |
| 2 | 25 | Gen. Elec. | I-K | 720 |
| 1 | 25 | Gen. Elec. | I-K | 600 |
| 2 | 20 | Gen. Elec. | KT312 | 1200 |
| 2 | 20 | Century b.b. 4 spd. | SC504 | 1800 |
| 2 | 20 | Whse. NEW-TEFC | CS364 | 1800 |

### 25 CYCLE MOTORS

| H.P. | Mfg. | Type | Speed |
|---|---|---|---|
| 450 | Whse. 2200 v. | CW sl. rt. | 750 |
| 150 | Whse. | HF sl. rg. | 500 |
| 150 | Whse. | C sq. cg. | 500 |
| 100 | Whse. | CCL sq. cg. | 500 |
| 50 | Allis Ch. | ANY sl. rg. | 1500 |

### D. C. GENERATORS

| KW | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Gen. Elec. 1 | MPC | 125/170 | 1150 |
| 75 | Whse. | S | 125 | 600 |
| 50 | Cr. Wheeler | CCD | 250 | 850 |
| 30 | Lincoln b.b. 600 amp. | | 50 | 1200 |
| 25 | Gen. Elec. | DLC | 125 | 900 |
| 20 | Allis Ch. (2) | | 125 | 475 |

### 60 CYCLE A.C. GENERATORS

| KVA | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 225 | Gen. Elec. | ATB | 240/480 | 900 |
| 200 | Elec. Machy. | 3 brg. | 240/480 | 600 |
| 165 | Elec. Machy. | BRKT | 240/480 | 900 |
| 150 | Allis Ch. 25 cycle | | 240/480 | 500 |
| 150 | Allis Ch. | B | 2300 | 900 |
| 100 | Cr. Wheeler | ped. | 240/480 | 600 |
| 50 | Elec. Machy. | | 240/480 | 1200 |

# ARTHUR WAGNER COMPANY

**1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409**

# REBUILT POWER EQUIPMENT

**READY TO SHIP!**

## ALTERNATING CURRENT MOTORS

### 3 ph., 60 cy.

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 7½ | Westg. | 220 | 1200 | CS-Sq. Cg. |
| 10 | G.E. | 220 | 1200 | MT-Slipring |
| 25 | Westg. | 220 | 570 | Sq. Cg. |
| 35 | Westg. | 440 | 680 | CCL-Sq. Cg. |
| 35 | G.E. 220/440/2200 | | 865 | I-Slipring |
| 40 | G.E. | 440 | 1200 | KT-Sq. Cg. |
| 40 | Reliance | 220/440 | 670 | Sq. Cg. |
| 50 | G.E. | 440 | 1200 | KT-Sq. Cg. |
| 75 | Ideal | 220 | 1200 | AT-Sq. Cg. |
| 100 | Flynn Weischel | 220/440 | 900 | 31V-RN Sq. Cg |
| 100/125 | Cr.Wh. | 220/440 | 1200 | Sq. Cg. |
| 125 | G.E. 220/440/550 | | 515 | Sq. Cg. |
| 175 | Elliott | 2300 | 720 | Sq. Cg. |
| 200 | Cr.Wh. | 440 | 505 | SR-Slipring |
| 200/250 | Westg. | 220/440 | 1800 | CW-Slipring |
| 400 | Westg. | 2200 | 435 | CW Slipring |

## COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll Rand Models 315 and 315A Portable Air Compressors with 105 Hp. Waukesha Oil Engines complete with accessories.

1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

## VARIABLE SPEED MOTORS

### 230 VOLT D. C.

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 40 | Roth | 385/1200 | |
| 163 | G.E. | 545/1000 | CD |
| 300 | G.E. | 400/600 | DMC |
| 400 | Westg. | 180/250 | NA |
| 25 | Westg. | 600/1200 | SK |
| 25 | Westg. | 325/975 | S |
| 10/15 | Electro Dy. | 600/1200 | |
| 10 | Westg. | 800/1600 | SA |
| 10 | Cr. Wh. | 690/895 | CMC |
| 10 | Westg. | 400/1600 | SA |
| 10 | Sprague | 625/1250 | LC |
| 4 | G.E. | 850/1700 | LC-S |
| 3 | Roth | 500/1000 | RS |

## SERIES WOUND MOTORS

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 175 | G.E. | 230 | 475 | MD |
| 80 | Westg. | 220 | 450 | 76-A |
| 68 | G.E. | 220 | 495 | CO-2007 |
| 50 | Northern | 220 | 600 | K |
| 40 | G.E. | 230 | 517 | |
| 35 | Westg. | 230 | 550 | 49D |
| 32 | Shaw | 230 | 485 | 5L2F |
| 3½ | Westg. | 230 | 1200 | L |

## 230 VOLT DC MOTORS

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 1/6 | Bodine | 3400 | |
| ¼ | Triumph | 525 | 14-F |
| 1½ | Master | 3450 | DM |
| 2 | Westg. | 1725 | CD |
| 3 | Westg. | 1725 | CD |
| 3 | Western Elec. | 1125 | E-20-R |
| 3½ | Westg. | 975 | S |
| 4 | G.E. | 850 | LC-8 |
| 5 | Westg. | 1150 | SK |
| 7½ | Westg. | 1150 | SK |
| 7½ | G.E. | 1700 | RC |
| 8 | G.E. | 950 | RC-11 |
| 10 | Cr. Wh. | 850 | CM |
| 10 | Westg. | 1750 | SK |
| 12 | Northern | 1475 | |
| 15 | Allis Chal. | 800 | |
| 20 | Westg. | 1750 | SK |
| 20 | Westg. | 600 | M |
| 20 | Westg. | 975 | S-6 |
| 25 | G.E. | 650 | MD |
| 25 | Westg. | 825 | SK113 |
| 25 | Westg. | 1150 | SK |
| 30 | Westg. | 700 | S-6 |
| 40 | Westg. | 625 | MC |
| 60 | Reliance | 1800 | |
| 80 | Westg. | 450 | 76-A |
| 163 | G.E. | 545 | CD |
| 200 | Cr. Wh. | 600 | CCM |
| 250 | Elliott | 850 | |

## MOTOR GENERATOR SETS—

1—150 KW. 720 rpm. 250 v. DC General Electric Generator direct driven by 1—175 HP. 2300 v. 720 rpm. 3 ph. 60 cy. Elliott synchronous motor.

1—175 KW. 250/275 v. 1200 rpm. Elliott Generator direct connected to a 3 ph. 60 cy. 440 v. 1200 rpm. Westinghouse motor.

1—200 KW. 125/250 v. DC Motor Generator Set consisting of
2—100 KW. 125 v. DC compound wound Generators direct coupled to 1—225 HP. 1200 rpm. 220 or 440 v. 3 ph. 60 cy. Westg. slip ring motor.

1—150 KW. 500 v. compound wound Ridgway Generator 900 rpm. direct connected to a 225 HP. 2200 v. 3 ph. 60 cy. Ridgway Synchronous Motor.

4—100 KW. 1200 rpm. 125 v. DC compound wound General Electric Generators direct driven by 127.5 KVA, 220 or 440 v. 3 ph. 60 cy. 1200 rpm. synchronous motors.

1—15 KW. 1150 rpm. 115/230 v. DC Westg. Generator direct driven by 20 HP. 220 v. 3 ph. 60 cy. type CS motor.

1—12½ KW. 110/220 v. single ph. 60 cy. 1800 rpm. Burke Electric AC Generator with a 20 HP. 230 v. DC motor.

1—75 KW. 250 v. compound wound Westg. Generator direct connected to a 100 HP. 3 ph. 60 cy. 220 or 440 v. Fynn Weischel synchronous motor.

## INDUSTRIAL TRUCKS

5—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.

5—New 4 ton Yale & Towne model Y8W Multi-Stroke Hand Lift Platform Trucks.

## PUMPS

1— 130 gpm. 50 ft. head Rayton Dowd Pump.
1— 378 gpm. 44 ft. head Dayton Dowd Pump.
1— 400 gpm. 16 ft. head Dayton Dowd Pump.
1— 500 gpm. 35 ft. head Dayton Dowd Pump.
1— 550 gpm. 88 ft. head Dayton Dowd Pump.
1— 600 gpm. 32 ft. head Dayton Dowd Pump.
1— 750 gpm. 20 ft. head Dayton Dowd Pump.
1— 750 gpm. 70 ft. head Dayton Dowd Pump.
1—3500 gpm. 90 head DeLaval Pump.
1—4000 gpm. 138 ft. head Ingersoll-Rand Pump.
1—8000 gpm. 100 ft. head American Well Works Pump.

***WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US***

## Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

# MOTORS • GENERATORS • TRANSFORMERS

## MOTORS

### 3 PHASE—25 CYCLE—220/440 VOLTS

| H.P. | Make | Type | Frame | RPM |
|---|---|---|---|---|
| 5 | West. | CS | | 750 |
| 5 | West. | CS | | 750 |
| 5 | West. | CS | | 750 |
| 5 | West. | CS | 453 | 750 |
| 5 | West. | CS | 453 | 750 |
| 5 | G.E. | KT | 948 | 1430 |
| 5 | G.E. | KT | 948 | 1430 |
| 5 | G.E. | KT | 948 | 1430 |
| 10 | G.E. | KT | 312 | 750 |
| 15 | G.E. | I Form K | | 750 |
| 15 | West. | CS | 573 | 750 |
| 20 | West. | CS | | 730 |
| 25 | West. | CS | | 730 |
| 40 | G.E. | I Form K | | 750 |
| 75 | G.E. | I Form K | | 500 |
| 100 | G.E. | I Form K | | 750 |
| 100 | West. (2200 v.) | CS | 871.52C | 1460 |
| 125 | West. (S.R.) | CW | | 480 |
| 150 | G.E. | I Form K | | 365 |
| 150 | G.E. (2200 v.) | I Form K | | 750 |
| 150 | G.E. (2200 v.) | I Form K | | 750 |
| 150 | Allis Ch | Slip Ring | | 720 |
| 150 | G.E. (2200 v.) | KT b.b. | 557Y | 1470 |
| 200 | West. (2200 v.) | CS | 1013 | 480 |
| 200 | G.E. (2200 v.) | I Form K | | 485 |
| 200 | G.E. (S.R.) | I Form M | | 480 |
| 200 | West. (S.R.) | CW | 1011 | 480 |

## MOTORS

### 3 phase, 60 cycle—220/440 volts

| H P. | Make | Type | RPM |
|---|---|---|---|
| 5 | American | Splash Proof BB. | 1200 |
| 5 | G.E. | Tri Clad | 1750 |
| 5 | G.E. | I Form K | 680 |
| 7½ | Amer. El. | Splash Proof BB. | 1200 |
| 10 | Amer. El. | Vertical BB. | 1200 |
| 10 | G.E. | KT956 | 1200 |
| 10 | G.E. | KT752 | 1200 |
| 15 | G.E. | KT312 | 855 |
| 15 | West. | CS | 1155 |
| 20 | West. | New BB. | 1200 |
| 20 | G.E. | Tri Clad BB. | 3600 |
| 20 | West. | New CS365 | 1800 |
| 25 | West. | New CS444 | 900 |
| 25 | West. | CS | 1200 |
| 30 | West. | New CS445 | 900 |
| 30 | West. | CS | 1200 |
| 40 | Cr. Wh. | | 885 |
| 40 | Lincoln | JM | 720 |
| 40 | G.E. | KT323 | 1740 |
| 50 | Al.-Ch. | | 1800 |

| H.P. | Make | Type | RPM | Ser. No. |
|---|---|---|---|---|
| 50 | Al. Ch. | | 1800 | 3K28825 |
| 60 | G.E. | 1 | 1800 | 292596 |
| 60 | Whse. 2200V. | CCL | 1200 | 854121 |
| 75 | Westhgse. | CS | 1800 | 2134671 |
| 100 | Westghse. | CCL | 1803 | 1043213 |
| 125 | Westghse. | CCL | 1800 | 765231 |
| 125 | Westghse. | CS | 1200 | 2318625 |
| 150 | Westghse. | CS | 1800 | 2429726 |
| 150 | G.E. | I-K | 1200 | |
| 250 | G.E. | I-K | 600 | 2246834 |
| 300 | G.E. | I-K | 720 | 2357743 |
| 400 | G.E. | I-K | 900 | 2347845 |

## FREQUENCY CHANGERS

**All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.**

## 25 CYCLE TRANSFORMERS

3—500 KVA Pennsylvania Transformers 25 Cycle, 1 Phase, 2300 Volts Primary 230/460 Volts Secondary.

## 60 CYCLE TRANSFORMERS

1—3000 KVA Kuhlman Transformer 60 Cycle, 3 Phase, 14,160 Volts Primary 240 Volts Secondary.

## 25 CYCLE GEARED MOTORS

3—10 H.P. Westghse., Frame 364 Encl. 1500/378 RPM.
1—15 H.P. Master, Frame 405 Encl., 1450/416 RPM. Exp. Proof.

## D.C. CIRCUIT BREAKERS

4—800 Amp. ITE air breakers 2 pole 250 volts complete with overload trips 600/1200 Amp.—mounted on slate panels.

## MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM. with panel board.

## SPECIAL

1—150 HP. Fairbanks Morse Ball Bearing Motor. 3/60/440/1800 RPM.
1—75 HP. Fynn-Weischel (Wagner) Synchronous Motor Serial #345781, 3 Phase 60 Cycle 440 Volts, 1200 RPM.
1—75 HP. Fynn Weischel Synchronous Motor 3 Phase 60 Cycle 440 Volts 1200 RPM. with starting control.
1—150 HP. Fairbanks Morse Ball Bearing motor 3/60/440/1800 RPM.
1—300 HP. Gen. Elect. Synchronous Motor. Type ATI. 3/60/440/1200 RPM., .8 PF. with direct connected exciter and starting equipment.
1—300 HP. Gen. Elect. Squirrel Cage Motor. Type I15—3/60/440 1200 RPM. with starting equipment.

## NEW MOTORS

100—New motors from ½ HP. to 30 HP. in stock, 60 Cycle single and 3 Phase.

## ROTARY CONVERTER

1—2000 KW. Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

## AIR COMPRESSORS

**2—5000 CFM Worthington low pressure 45 lb. Compressors with 500 H.P. Gen. Elect. Motors. 3 phase 25 cycle 2300 volts.—Complete.**
**2—1000 CFM 100 lb. Compressors Driven by 200 HP. Motors.**
**1—1700 CFM Worthington 2 Stage 100 lb. with motor.**

2—5000 CFM. Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

## 2300 VOLT PRIMARY CONTACTORS

2—150 H.P. Westinghouse AC magnetic controllers 3/60/2300 V.
1—225 H.P. Square D magnetic controller 3/60/2300 V.
2—200 Amp. Schweitzer-Conrad Load Breaks—3 Pole Fused. 3/60/2300 V.

## ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

# ELECTRICAL CONTROL APPARATUS

## FEEDER PANELS

**1—5000 KW. Two service feeder panel including:**

4 externally operated disconnect switches.

2 solenoid operated GE type BL2 7500 volt 1200 amp oil circuit breakers. Integrating KWH meters, ammeters, KW meters, potential and current transformers, etc.

**3—1500 KW Feeder panel including:**

2 externally operated disconnect switches.

2 solenoid operated GE type PL2 15000 volt 400 amp oil circuit breakers. Integrating KWH meters, ammeters, KW meters, etc.

## SWITCHING PANELS

**1—4 Section fully enclosed remotely operated panel including:**

4 disconnect switches and bussing.

4 solenoid operated GE type PLI 7500 volt 400 amp oil circuit breakers. Resets, rectifier and relay apparatus, remote station on-off switches, etc.

**1—3 Section fully enclosed remotely operated panel including:**

3 disconnect switches and bussing.

3 solenoid operated GE type PLI 7500 volt 400 amp oil circuit breakers. Resets, remote station on-off switches, etc.

**1—3 Section fully enclosed panel including:**

3 disconnect switches and bussing.

3 manually operated Bepco type SB13 7500 volt 400 amp oil circuit breakers. Comp. thermal relays, under and over voltage protection, resets, etc.

## POWER PANELS

**1—Square D power panel with fuses and integrating KWH meter.**

Externally operated switch and 7 breakdowns—350, 350, 150, 150, 150, 60 and 20 amps.

**1—Square D power panel with fuses and integrating KWH meter.**

Externally operated switch and 6 breakdowns—4@200 & 2@100 amps.

**1—Square D power panel with fuses and integrating KWH meter.**

Four breakdowns—200, 150, 150, and 100 amp.

**General Machinery LTD**

GRANVILLE ISLAND, VANCOUVER, B.C. Tel.:PAcific 3487

# *FOR SALE*—TO HIGHEST BIDDER
# WONDERFUL BUY OF FOLLOWING EQUIPMENT AND MATERIALS

*We reserve the right to accept or reject any bids that are made*

**1—ALLIS CHALMERS Slip Ring Motor** #2K1356601—250 HP, 870 RPM, 220 Volt, 3 ph., 60 cycle, 59 Amp. Electrically OK. Rings need repair.
**1—GENERAL ELECTRIC Slip Ring Motor** #1180131—150 HP, 720 RPM, 2200V., 3 ph., 60 cycle, Form M, 36 Amp. Runnable.
**1—WAGNER Slip Ring Motor** #336186—100 HP, 685 RPM, 2200 V., 3 ph., 60 cycle, 27 Amp., Type 31X5BP Runnable.
**1—WESTINGHOUSE Electric DC Motor** #2592064—25 HP, 600 RPM, 230 VDC—92 Amp. Armature needs rewound.
**1—WESTINGHOUSE Electric Slip Ring Motor** #1865865—200 HP, 514 RPM, 2200 V—3 ph., 60 cycle, 50 Amp., Type CW Form 1002. Stator needs rewound.
**1—CROCKER-WHEELER DC Motor** #561875—5 HP, 1750 RPM, 230 VDC, 18.5 Amp. Electrically OK.
**1—WESTINGHOUSE ELECTRIC DC Motor** #233501—30 HP, 975 RPM, 230 VDC, 119 Amp. Electrically OK.
**1—GENERAL ELECTRIC AC Motor** #1053934-25 HP, 1200 RPM, 220 VAC, 3 ph., 60 cycle, 61 Amp., type KT 326. Electrically OK. Trying to trade.
**1—GENERAL ELECTRIC—AC Motor** #694784—10 HP, 1800 RPM, 220 VAC, 3 ph., 60 cycle, 24 Amp., type KT Form C. Electrically OK. Trying to trade.
**1—GENERAL ELECTRIC Synceronise Motor** complete with motor driven excitor and all starting equipment—#5636420—300 HP, 360 RPM, 2200 V—3 ph., 60 cycle, Type T3 Form HL. OK. Purchased from Duquesne Electric & War Assets.
**1—ALLIS-CHALMERS Slip Ring Motor** #5082-K-Y-41C—150 HP, 695 RPM, 2200 V, 3 ph., 60 cycle, 36.5 Amp. Electrically OK. (#11 Beater Motor).
**1—HAWTHORNE ELECTRIC D.C. Motor** #328843—15 HP, 925 RPM, 230 VDC, 55.8 Amps., Type 1-VC-1. Needs Rewound.
**1—WORTHINGTON Pump Head Motor** #GC3495—5 HP, 3425 RPM, 230 VDC, 20 Amp., Type DM Frame 6240. Electrically OK.
**1 WESTINGHOUSE ELECTRIC DC Motor** #2-5T-97B—4 HP, 1175 RPM, 220 VDC, 17 Amp., Type S. Electrically OK.
**1—WESTINGHOUSE ELECTRIC DC Motor** #112692—5 HP, 1300 RPM, 230 VDC, 21 Amp., Type S. Electrically OK.
**1—MASTER ELECTRIC Gear Head Motor** #G.E.863—1 HP —1725 to 96 RPM, 230 VDC, Form DM Frame 4060 Style 35592. Electrically and mechanically OK.
**1—GENERAL ELECTRIC DC Motor** #T4554—7-1/2 HP, 850 RPM, 230 VDC, 30.2 Amp., Form A24 Type RC. Needs Rewound.
**1—ROBBINS & MYERS Electric Hoist.** #H1489—1/2 Ton Type L 1/2 DB, 230 VDC. OK.
**1—WRIGHT ELECTRIC Hoist** #54879—1/2 Ton Type LR 1/2, 230 VDC. OK.
**1—SHEPPARD LIFT-About-Hoist** #25-1-1-503-1 ton type 21-4, 230 VDC. OK.
**1—DETROIT ELECT. HOIST.** Capacity 1 ton—230 VDC. OK.
**1—YALE Elect. Chain Hoist.** Md. 20B—1 ton, 230 VDC. OK.
**3—GENERAL ELECTRIC Oil Circuit Breakers.** Ty. FK20. OK.
**4—GENERAL ELECTRIC** Drum Controllers. T108A. OK.
**3 sets**—5000 V, 3 pole S.T. **Disconnect Switches.**
**1—WESTINGHOUSE Drum Controller** #583256. Needs Repairs.
**1—WESTINGHOUSE DRUM Controller** Type 20B. OK.
**6 sets**—Starting resistance **Cast Iron Grids.**
**120—SYLVANIA Heater Lamps** Type R4D—115V. Orig. Cartons.
**1—WESTINGHOUSE ELECTRIC DC Automatic Starter** Style 4PT Series, 15 HP, 230 VDC.
**1—TURBINE Generator**—This is General Electric alternating current generator #636889, type ATB 2-2500-3600, Form 1, 620 amp., 2000 KW, 2300 V. 3600 RPM Direct coupled to one General Electric DC Excitor, #62196, type ED-2-17-36 Form T, 125 V., 136 amp., 3600 RPM. Driven by one Curtiss Steam Turbine #13802, 2000 KW, 3600 RPM, Form G, 140 lb., steam, condensing pump. C. H. Wheeler Mfg. Pump #12394, driven by one G. E. Induction Motor #1304249, type KT 180-4-7½-1800, Form C, 2200 V., AC 3 ph., 60 cy.
Complete with G. E. Starting Compensator CR 10 type NR 1606, Form H, 2 PL, 220 V., 3 ph., 60 cy., and one Bulldog Electric Switch 53322 D.
This Turbine Generator outfit is complete with C. H. Wheeler Surface Condensor, all the necessary meter switch gear and voltage regulator. Also has surface Condensor.
**3—ILG Ventilating Fans** 1/4 HP, 230 V. DC, 855 RPM. Formerly used for exhausting air from plant. Capacity of 500 cu. ft. per minute.
**2—General Electric CP27 Compressor Head Air Pumps** 230 V. DC complete with pressure line switches. These are good for 100 lbs. pressure at 300 cu. ft. per minute.

## TARENTUM PRODUCTS CORPORATION

**TARENTUM, PENNSYLVANIA** *Contact* **Mr. J. V. Mason** *Telephone* **Tarentum 1470**

# NEW—REBUILT & GUARANTEED MOTORS-M-G SETS-TRANSFORMERS

### A. C. MOTORS
**3 ph 60. cy.**

| Qn. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2 | 50 | Gen. Elec. | K7337 | 220/440 | 1800 |
| 3 | 50 | West. | CS | 220/440 | 1800 |
| 2 | 60 | Allis Chal. | | 220/440 | 1800 |
| 1 | 25 | Gen. Elec. | KT | 220/440 | 900 |
| 2 | 30 | Gen. Elec. | IK | 220/440 | 1800 |
| 2 | 40 | Gen. Elec. | IK | 220/440 | 1200 |
| 1 | 60 | Rob. Meyers | K-209 | 220/440 | 1200 |
| 1 | 50 | Gen. Elec. | KT-346 | 220/440 | 900 |

### A. C. MOTORS
**3 ph. 25 cy.**

| Qn. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2 | 20 | Gen. Elec. | IK | 220/440 | 750 |
| 2 | 15 | Gen. Elec. | IK | 220/440 | 750 |
| 1 | 60 | Gen. Elec. | IK | 220/440 | 1500 |
| 2 | 30 | Allis Chal. | | 220/440 | 750 |
| 1 | 50 | Wagner | Sl. Rg. | 220/440 | 900 |
| 2 | 25 | Gen. Elec. | KT-337 | 220/440 | 750 |
| 2 | 25 | Westinghouse | CS | 220/440 | 750 |

### #3 WELDERS—GENERATOR TYPE
**3 phase, 60 cycle, 220/440 volts**

1—200 Ampere, Wilson on wheels.
6—300 Ampere Hobart on wheels.
6—400 Ampere Lincoln.
1—400 Ampere Wilson Hornet on wheels.

### WELDERS—TRANSFORMER TYPE
**1 phase, 60 cycle, 220/440 volts**

2—100 to 600 Ampere Wilson Bumble Bee.
1—500 Ampere Westinghouse on wheels.
2—300 Ampere Westinghouse on wheels.
3—250 Ampere Westinghouse on wheels.
1—OWEN-OSCILLATOR Trans. Type 3 ph., 60 cy., 220/44 volt with 10 heat ranges.
1—200 Ampere Wilson Generator type 2 phase, 60 cycle, 220/440 volt.

### TRANSFORMERS
3—50 KVA. Gen. Elec. 25 cy., 2300 pri. 115/230 Sec. type H.

### M.G. SETS
1—22½ KW. 250 volt, D.C. Driven by Westinghouse type CCL 3 ph., 60 cycle.

**150 New Ph. P. Peerless Splash proof Ball Bearing Motors, 3 ph. 60 cycle, 220/440 Volt., 1800 RPM.**

***We buy for cash. Send us your list of surplus equipment.***

## VOLLAND ELECTRIC EQUIPMENT CO., INC.

**1512 NIAGARA STREET** **BUFFALO 13, N Y.**

**PHONE GR 2715**

# COMPLETE COAL HANDLING— COAL STORAGE SYSTEM

**100 Ton/Hr. Link Belt Conveyor—Grinders—Scrapers, etc., for 20,000 Ton Storage. All supporting steel—motors—screens—belts—complete**

(A) Track hoppers with girders for two track siding.
(B) 2-Apron feeder conveyors 30' and 20' from hopper pit.
(C) Dragline (scraper) coal storage system about 200'x150' with winder, scraper, controls.
(D) Drag operators house with crusher housing, all steel—crushers, controls, etc.
(E) Conveyor section #1, 20" troughing conveyor, from crusher pit to junction tower. 182' at 16° incline from elevation minus 10' to plus 36', steel housing and walkway.
(F) Junction tower 12'x18'x46' high with controls, etc.
(G) Conveyor section #2, 20" troughing conveyor, from junction house to boiler house. 185' at 12° from elevation 26' to 67', steel housing and walkway.
(H) Conveyor section #3, 20" troughing conveyor, over bunkers about 185', 24" diameter heavy duty magnetic head pulley.
(I) Automatic self-propelled self-reversing belt tripper.
105 carrying idlers—3 pulley troughing type 5" diameter on 5' centers.
53 return idlers 5" diameter on 10' centers.

## 20 TON—SHAW BOX—OVERHEAD CRANE

Motor operated hoist—hand bridge and trolley traverse. Crane Span 30'6", lift 30'60", hoist speed 5 feet/minute. Hoist motor 10 HP, 60 cycle, 3 phase, 440 volts. Runway and track 160', complete with supporting steel for power house operation.

## THOMAS ROME AND ASSOCIATES, INC.

**307 E. FOURTH ST.,** **CINCINNATI 2, OHIO**

# KIEMLE OFFERS

## *Rebuilt and Sold with a Standard New Guarantee*

**IND. FREQUENCY CHANGER SETS**

**MOTOR GENERATOR SETS**
**ALTERNATORS, ALL FREQUENCIES**
**TRANSFORMERS, LARGE STOCK**
**D. C. GENERATORS, ALL VOLTAGES**
**CONTROL EQUIPMENT**

**ALL SIZES VOLTAGE AND CYCLES**

**3 ph. 60 cy. A.C. Motors**
**3 ph. 25 cy. Motors**
**125 Volts D. C. Motors**
**230 Volts D. C. Motors**
**550 Volts D. C. Motors**

**THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO**

**Put all idle equipment to work. Send your list for prompt action.** **WRITE OR WIRE YOUR INQUIRIES**

# POWER EQUIPMENT

1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condensor.
1—625 KVA, 3 ph., 60 cy., 480 vlt., 900 RPM, Westgh. Generator to a Westgh. non-condensing turbine.
265 new Gen. Elec. transformers 3 to 75 KVA, 450 to 117 vlts.
68 new Gen. Elec. transformers 3300-6600-11000 to 120-240 vlts type HSBA.
1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt. 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs. 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt., 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

***Send us your inquiries, our stock is continually changing***

## KEYSTONE
## Power Plant Equipment Company

**8403 Hegerman St.** **Phila. 36, Penna.**

# New! 300 KW
## *WESTINGHOUSE*
## GENERATORS

- **SHUNT WOUND**
- **240/120 VOLTS D.C.**
- **1250 AMPS.**
- **400 R.P.M.**
- **MARINE TYPE HOUSING**
- **SINGLE BEARING**

Pedestal outboard Bearings for Direct Connection to Engine or water-wheel.

PRICE $2250. NET

**Wire, write or phone Main 4-5181**

*Benjamin's for Motors*

ESTABLISHED 1904

**130 Clinton St. ★ Brooklyn, N. Y.**

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***Rebuilt & Guaranteed***

**PUMPS**—Large stock centrifugal—turbine—piston.

**STEAM PUMPS**—Duplex - Simplex. Reconditioned and guaranteed.

**BOILERS**—stacks—Engine Generators—condensers.

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**PUMP & MACHINERY COMPANY**
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One (1) 750 H.P. Union Boiler, 250# pres.
One (1) Steel Stack with Breeching.
Westinghouse 7 Retort Stoker.
Forced Draft Fan Turbine Drive
Bailey Meter, Hagan Controls
Copes Feed Water Regulator
Richardson Scales
One (1) 150 H.P., 150# pres. Universal Boiler, Brick Set
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**New & Guaranteed Rebuilts**
**Stationary & Portable**

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**SINGLE PHASE—OISC**

3—2000 KVA GE 13200/26000 to 2300 V.
7—4000 KVA GE 15950/27600 Y to 13800/6900 4160 V.
6— 667 KVA 1100/22000 to 440 V.
6— 667 KVA 1100 22000 to 440 V.
6— 667 KVA GE 35000 to 440/220 V.
6— 200 KVA Whse. 11000 to 440/220 V.
3—2000 KVA Whse. 33000 to 11000 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
2—1200 KVA Whse. 66000/2300/4000 Y.
6— 500 KVA Whse. 24,000 to 220/110 V.
3—2000 KVA 33000 to 13,200/6600 V.

**THREE PHASE**

1— 3000 KVA GE. 11600 to 440 V.
1— 1200 KVA Whse. 6600 Y to 2300 V.
1—15000 KVA Pitts. 27880 to 4560Y. V.
3— 450 KVA GE. 66000Y to 440 V.
6— 650 KVA GE. 13200 to 2300 V.

**WATER COOLED—SINGLE PHASE**

4—3333 KVA GE. 25/60 Cy. 6000 to 4000/6925Y 8000/13850.
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.
7— 750 KVA. Whse. 33000 to 2200.
7— 675 KVA Whse. 33000 to 2200.

**PYRANOL**

1—3000 KVA Penna. 25 cy. 13,800 to 480 V., 1 ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy., 1 ph.

**NETWORK TRANSFORMERS**

19—150 KVA GE. type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
8—200 KVA GE. type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

**STATION-TYPE REGULATORS**

4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim. 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial number 582020.

**PHILADELPHIA TRANSFORMER CO.**
2829 Cedar St. Phila., Penna.

## HEAVY DUTY DIESELS

720 HP Fairbanks Morse model 33, 5 cyl. 580 KVA 2300 volt F-M Generator. Late type. Complete.
560 HP. Fairbanks Morse model 33, 4 cyl. 470 KVA 2300 volt F-M Generator. Late type. All accessories.
300 HP McIntosh Seymour 4 cycle, 3 cyl. 200 KW G-E 2300 volt Generator. Perfect shape. Very low priced.

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507 Locust St. St. Louis 1, Mo.

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INDUSTRIAL & MARINE
**METROPOLITAN**
**PLUMBING SUPPLY CO., INC.**
Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
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CRUTCH PIPE & FITTINGS

## BOILERS

2—400 H.P. Erie City, type E stokers, OHIO PENNSYLVANIA & ASME stamping.
2—400 H.P. Springfield sectional header, oil burners, N. J. & ASME stamping.
2—25,000# B & W Stirling's, unit pulverizers, National Board Stamping.

**H. P. BREARLEY**
3423-91st Street, Jackson Heights, N. Y.

## ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

## HEADQUARTERS FOR D.C. MOTORS!

**230 VOLT CONSTANT SPEED D .C. MOTORS**

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 22 | 2 | 850 | West. | SK-20 |
| 20 | 3 | 1150 | West. | SK-20 |
| 10 | 3 | 850 | Reliance | T-23T |
| 25 | 3½ | 850 | West. | SK-30 |
| 3 | 7½ | 1750/1310 | West. | SK-43 |
| 2 | 7½ | 1150 | G.E. | CDM-66 |
| 2 | 7½ | 875*1750 | West. | SK-63L |
| 3 | 7½ | 850 | G.E. | CD-75 |
| 5 (new) | 10 | 1150 | Al.-Ch. | EB-80 |
| 1 | 10 | 850 | West. | SK-83 |
| 10 (new) | 12½ | 600 | West. | SK-93 |
| 5 | 15 | 825 | West. | SK-90 |
| 3 | 20 | 1750*1310 | West. | SK-83 |
| 2 | 20 | 1150 | G.E. | RC-30 |
| 11 | 20 | 750 | West. | SK-110L |
| 17 | 25 | 825 | West. | SK-120 |
| 1 | 30 | 750 | G.E. | RC |
| 1 | 40 | 1700 | West. | SK-103 |
| 1 | 40 | 750 | G.E. | RC-34 |
| 1 | 50 | 650 | G.E. | RC-16 |
| 2 | 60 | 1750/1310 | West. | SK-143 |
| 3 | 75 | 850 | West. | SK-160 |
| 1 | 100 | 1150 | West. | SK-163 |
| 1 | 150 | 700 | Al.-Ch. | |
| 2 | 200 | 1150 | G.E. | RC-38 |
| 1 | 250 | 1150 | C.W. | CMC-101A |

**SLIP RING MOTORS—3 Ph., 60 Cy.**

| Qn. | H.P. | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 3 | 1750 | 440* | West. | CW-232C |
| 1 | 5 | 580 | 220* | G.E. | HI-9 |
| 6 | 7½ | 810 | 550 | G.E. | MTC-5201 |
| 1 | 7½ (new) | 575 | 220* | G.E. | MT-522 |
| 2 | 10 | 1140 | 440* | West. | HF-7A |
| 2 | 10 | 570 | 220* | G.E. | HI-11 |
| 3 | 11 | 810 | 550 | G.E. | ITC-5008 |
| 1 | 15 | 900 | 440* | G.E. | MTC-5302 |
| 2 | 15 | 570 | 220* | West. | CW-646 |
| 1 | 18 | 680 | 440* | West. | MW-316 |
| 1 | 20 | 1750 | 440* | West. | CW-471A |
| 1 | 25 | 1130 | 550 | G.E. | MT-323 |
| 2 | 25 | 850 | 220* | Wagner | BR |
| 2 | 25 | 720 | 440* | Wagner | 22VBR |
| 1 | 30 | 865 | 440* | West. | CW-646 |
| 1 | 30 | 850 | 440* | G.E. | MT-332 |
| 1 | 30 | 675 | 440* | G.E. | MT-336 |
| 2 | 35 | 600 | 440* | Fb-M | HV-H16A |
| 2 | 40 | 865 | 2200 | Al-Ch. | ARY-223C |
| 1 | 40 | 560 | 440* | G.E. | MT-346 |
| 1 | 50 | 860 | 440* | West. | HF-12A |
| 5 | 52 | 550 | 220* | G.E. | IQC-5013*** |
| 1 | 60 | 1200 | 2200 | G.E. | MT-B-343 |
| 1 | 60 | 685 | 440* | West. | CW-758 |
| 1 | 60 | 570 | 550 | G.E. | MTC-5546 |
| 1 | 60 | 345 | 550 | West. | CW-930-39 |
| 1 | 75 | 720 | 550 | G.E. | MT-556 |
| 1 | 80 | 575 | 440* | G.E. | MTC-5352 |
| 1 | 100 | 1760 | 220* | Al.-Ch | ARY-223BS |
| 2 | 125 | 430 | 440* | G.E. | IL-16 |
| 2 | 150 | 1750 | 440* | G.E. | MTP-549 |
| 1 | 150 | 680 | 440* | West. | C1-856-C |
| 1 | 150 | 490 | 2300 | West. | CW-956A |
| 1 | 150 | 385 | 550 | G.E. | IM-17 |
| 1 | 175 | 505 | 550 | West. | CW-1002 |
| 2 | 200 | 600 | 550 | G.E. | IM-17 |
| 1 | 200 | 495 | 2200 | G.E. | I-17A |
| 3 | 250** | 296 | 220/380 | West. | CW-20-53-15 |
| 1 | 30 | 514 | 550 | G.E. | IM-17A |
| 1 | 400 | 505 | 550 | West. | CW |

*Can be furnished for either 220 or 440 volts, but not both voltages.
**50 Cycle (New). ***2 Phase. #Wound Rotor.

**230 VOLT ADJUSTABLE SPEED D. C. MOTORS**

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 10 | 1½/2 | 500/200 | G.F. | CD-65 |
| 1 | 2 | 225/900 | Reliance | 78T |
| 6 | 5/7½ | 600/1800 | G.E. | RA-30 |
| 1 | 10 | 400/1200 | G.E. | RF-10 |
| 1 | 12½ | 280/840 | West. | SK-130 |
| 10 (new) | 12½ | 600 | West. | SK-93 |
| 1 | 15 | 600/1800 | Reliance | T-131T |
| 1 | 15 | 400/1200 | G.E. | RF-11 |
| 1 | 15/20 | 500/1500 | G.E. | CD-95 |
| 3 | 20 | 400/1200 | G.E. | RF-12 |
| 1 | 23/29 | 300/1200 | G.E. | RF-13 |
| 1 | 30 | 400/1200 | West. | SK-163 |
| 1 | 35 | 500/1500 | West. | SK-143 |
| 3 | 40/50 | 400/1600 | Al.-Ch. | EB-147 |
| 1 | 75 | 500/1500 | Cr.-Wh. | CCM |
| 5 | 100 | 400/1200 | Al.-Ch. | |
| 3 | 100 | 320/960 | West. | SK-200 |
| 1 | 175 | 230/750 | West. | SK-220 |
| 2 | 375 | 350/500 | G.E. | MPC |

**CRANE, MILL TYPE 230 VOLT—D. C. MOTORS**

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 2 | 3½ | 700 | G.E. | CO-1803 |
| 1 (new) | 10 | 650 | G.E. | MD-403-BE |
| 2 | 10 | 690 | West. | K-4 |
| 1 | 13 | 575 | G.E. | CO-1806 |
| 3 | 25 | 590 | Diehl | TE |
| 2 | 27 | 490 | West. | MC-40 |
| 3* (new) | 35* | 600 | West. | CK-9 |
| 1 | 50 | 600 | West. | CK-9 |
| 5** (new) | 50** | 525 | G.E. | COM-1830AE |
| 1 | 59 | 470 | G.E. | CO-2007 |
| 2 (new) | 60 | 550 | G.E. | COM-1831AE |
| 4 | 65 | 450 | G.E. | COM-1830 |

*Available with West Type DW Frame 135F, Style 487555, Shunt Wound Brakes.
**Available with G.E. CR9523B313M2. Cat. 823043-G24 Shunt Wound Brakes.

**SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.**

| Qn. | HP | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 15 | 3485 | 220* | Reliance | AA-B3247 |
| 2 | 20 | 1160 | 440* | West. | CS-554 |
| 1 | 25 | 1140 | 2200 | West. | CCL |
| 2 | 25 | 705 | 440* | West. | CS-W504-TEFC |
| 1 | 25 | 690 | 440* | G.E. | KT-336 |
| 1 | 30 | 870 | 220* | West. | CS-646 |
| 2 | 30 | 1160 | 440* | West. | CS-644 |
| 1 | 50 | 900 | 2200 | G.E. | KT-346 |
| 1 | 50 | 850 | 220* | West. | CCL |
| 1 | 75 | 1750 | 2200 | West. | CS-761 |
| 1 | 100 | 495 | 2200 | Al-Ch | AN |
| 1 | 100 | 580 | 2200 | G.E. | IK-15 |
| 2 | 100 | 500 | 2200 | West. | CS-930 |
| 3 | 150 | 1800 | 440* | Howell | N-684 |
| 4 | 260 | 580 | 550# | G.E. | KT-5668 |
| 1 | 700 | 1800 | 2300/4000 | West. | CD-4-39D-12 |

*Can be furnished either 220 or 440 volts, but not both voltages. #Reconnectable for 440 volts.

**SYNCHRONOUS MOTORS—3 Ph., 60 Cy.**

| Qn. | HP | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 20 (new) | 900 | 220 | West. | |
| 1 | 50 | 1800 | 2300 | G.E. | TS-7543P |
| 1 | 50 | 720 | 440 | Wagner | 26V87RN |
| 2 | 50 | 600 | 400 | G.E. | TS-7556 |
| 1 | 93 | 900 | 2400 | E.M. | |
| 1 | 100 | 750 | 440 | West. | (25 cycle) |
| 1 | 150 | 720 | 4000*2300 | G.E. | Single bear. |
| 1 | 220 | 200 | 2200 | West. | |
| 1 | 300 | 900 | 4600 | E.M. | |
| 1 | 750 | 720 | 4150/2300 | G.E. | ATI-single bearing |

**VARIABLE VOLTAGE DRIVES (2)**

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

**NEW AIR CIRCUIT BREAKERS (5)**

General Electric, 2 pole. Enclosed Manually Operated. Type AE-1B-Y1, 600 Volts, 60 Cycle. 220 Volt Shunt Trip, with Two Instantaneous Overload Trips Calibrated 600 to 1500 Amperes.

**NEW A.C. GENERATORS**

1—Leland. 2.5 KVA, 120 Volt, 1800 RPM, 60 cycle, Single Phase. Type AG, Frame 50, Form BOWJH, Continuous, Self-Excited.

The Above Listings Are Representative of Items Available for Prompt Shipment from Our Cleveland Warehouse.
We Also have a large Stock of Rotary Converters, AC and DC Generators, Circuit Breakers and Controls.

**ELECTRIC GENERATOR & MOTOR CO.**
4521 HAMILTON AVE. CLEVELAND 14, OHIO

## COMPLETE POWER PLANTS

**STEAM—ELECTRIC—HYDRO—DIESEL**

*"Export Orders Carefully Executed"*

**SPECIAL OFFERING**

**1400/2200 KW Turbo-Generator, non-condensing, Excellent Condition**

3—90,000# Boilers 575#
4—100000# Boilers 300#
1—225000# Boiler 450#
4—1000 H.P. Heine Boilers 225#
2— 825 H.P. B & W Sterling Boilers 200#
2—600 H.P. Edge Moor 200# Stokers
Smaller Boilers and Fire Tube Boilers also

Several 425# and 550# Turbo-Generators available
2—3000 K.W. Turbos @ 350#
2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—6500 K.W. G.E. Co. Turbo-Generator Condensing
1—2000 K.W. W.E. & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2—750 K.W. G.E. Co. Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

**Non-Condensing Turbos—300—500—750—and 1,000 K. W. & Larger**

**CHARLES B. REARICK 30 CHURCH ST. NEW YORK**

**BOILERS**

2—1947 HP Heine Boilers 200#
4—1010 HP Heine Boilers 200#
2— 786 HP B. & W. Stirling 180#
2— 750 HP B. & W. Stirling 190#
1— 650 HP Casey Hedges 225#
1— 519 HP Titusville 3 drum Boiler 200#
3— 500 HP Connolley Boiler 200#—1930
2— 404 HP Springfield Sec. Header Boilers 200#
1— 400 HP B. & W. Sec. Header Boiler 160#
3— 318 HP B. & W. Stirling Boilers 200#
1— 216 HP Vogt 3 drum Boiler 160#
1— 80 HP Cyclotherm Steam Generator 125# (New)
1— 40 HP Laffel Scotch Marine Boiler 125#

**TURBINES**

1—22,500 KW General Electric Condensing Turbine, Rebuilt.
1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW, 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine
1—2000 KW General Electric Condensing Turbine.

**DIESEL ENGINES**

1—360 KW Chicago Pneumatic—480 Volts—New.
2—400 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.

**ENGINE GENERATOR SETS**

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.

**MISCELLANEOUS**

300 HP Kerr, 3600 Non Condensing Turbine.
2500 HP Cochrane Open Feed Water Heater.
1—150 HP Canton Ram-fed Stokers.

SEE Fletcher FIRST!

**FLETCHER SALES CO.**

325 Fincastle Building — LOUISVILLE, KY.



# FOR SALE

1—NEW TERRY Model C-2, 500-KW, 1800 RPM, Non-Condensing Turbine, 175# p.—5# Back Pressure, Serial No. 19036, Direct-Connected to:

1—GENERAL ELECTRIC 500-KW, 80% P. F., 625 KVA, 3-phase, 60-cycle, 240-480 or 2300 volts, 1800 RPM, GENERATOR, with a Direct-Connected 7½-KW Exciter. Generator Serial No. 5,636,793.

Turbine suitable WITHOUT CHANGES for maximum conditions 250# pressure, 500 degrees TT and 50# G. Back Pressure.

**ALL NEW IN 1944 AND NEVER USED!**

**WALTER H. WILMS & COMPANY**

2526 Guardian Building, Detroit, 26, Mich.



*FOR SALE*

# HYDRAULIC PUMPS

Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2-¾" x 8", equipped with Herringbone Gears, 67.5 gpm. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate. Motors are 75 HP, 3/60/220-440 volts, 740 RPM. Complete with starting panel, consisting of G. E. motorstarter switch, push button control, square "D" Switch, and capacitator. Purchased new 3-½ years ago. Excellent condition. Available for immediate delivery.

**CONSOLIDATED PRODUCTS CO.**

INC.

14-17 Park Row New York 7, N. Y.



**APPLICATION ENGINEERS**

45 KW M. G. Set 2200 AC 250 DC.
100 KW. M. G. Set 220/440 AC 125/250 DC.
300 KVA Fairbanks Morse Diesel Set.
200 KW 480 volt Ridgway Engine Set.
2500 KW 2300 volt 200 lb. GE Cond. Turbine.
150 HP 720 rpm 2200 volt GE Cage Motor.

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P&H 42'1½" Span
Case 51'2" Span
P&H 37'6" Span
Niles 20' Span
Shepard 28' Span

**5-TON**
Alliance 95' Span
P&H 20' Span
Shepard 27'6" Span
Detroit 38'8" Span
P&H 75' Span
P&H 31'10" Span

**6-TON**
Northern 46' Span

**7½-TON**
P&H 60' Span
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Shepard Niles 27'7½" Span
Morgan 55'6" Span
Ederer 74'4" Span
Lane 50' Span
Cleveland 51'3" Span
2 Yd. Morgan 60' Span
Northern 49'7" Span
Shepard Niles 57' Span
P&H 87'6" Span
Lane 60' Span
Shaw 80'9" Span
Toledo 77' Span

Whiting 48' Span
Shaw 67'6" Span
Morgan 38' Span

**15-TON**
Whiting 38' Span
Ederer 74'4" Span
New Albany 50'6" Span
Morgan 73'5½" Span
Bedford 34'6" Span

**20-TON**
Lane 50' Span
P&H 51'4" Span
Ederer 74'4" Span
Northwestern 60' Span
Whiting 75' Span

**25-TON**
Bedford 14'6" 67'8" 46'2" Spans
Leonard Burke 100' Span
Case 63' Span

New Albany 50' Span
Cyclops 74'4" Span

**30-TON**
Ederer 55' Span
Ederer 66'6" Span
Whiting 74'4" Span
Northern 75' Span
Ederer 40' Span
Ederer 76' Span

**35-TON**
Bedford 25'9½" Span
Cyclops 74'4" Span

**50-TON**
Morgan 50' Span

**75-TON**
Case 64'8¼" Span

**150-TON**
Whiting 30' Span

**200-TON**
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ROCHESTER 1, N. Y.

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## SLIP RING MOTORS

3-PH., 60 Cy.

| HP | Volts | Make | Speed |
|---|---|---|---|
| 300 | 440 | Al. Chal. | 900 |
| 250 | 2300 | G.E. | 600 |
| 350 | 440/550 | G.E. | 600 |
| 200 | 2200/440 | G.E. | 600 |
| 150 | 2200/440 | G.E. | 600 |
| 125 | 440/220 | G.E. (Hoist) | 900 |
| 100 | 440/220 | G.E. MTC | 900 |
| 100 | 550 | G.E. | 900 |
| 80 | 440/220 | G.E. (MTC) | 900 |
| 75 | 440/220 | G.E. (MTC) | 600 |
| 60 | 440/220 | G.E. | 1200 |
| 50 | 2200/440 | G.E. | 600 |
| 75 | 550 | G.E. | 900 |
| 40 | 2200 | Whse. | 900 |

## SYNCHRONOUS MOTORS

3-PH., 60 Cy.

| /HP | Volts | Make | Type | RPM |
|---|---|---|---|---|
| 600 | 4000/2300 | Cr. Wh. | SYN. | 900 |
| 500 | 4000/2300 | Cr. Wh. | SYN. | 900 |
| 500 | 440/220 v. | G.E. | TS | 900 |
| 300 | 440/220 | G.E. | ATI | 600 |
| 300 | 4150/2300 | Cr. Wh | SYN | 900 |
| 300 | 440/220 | Al. Ch. | | 600 |
| 250 | 4000/2300 | G.E. | TS | 1200 |
| 240 | 2200 | G.E | ATI | 600 |
| 200 | 4150/2300 | Whse. | G | 1800 |
| 200 | 2200 | G.E. | ATI | 514 |
| 150 | 4150/2300 | G | G | 1800 |
| 150 | 440/220 | G.E. | ATI | 900 |
| 150 | 2200/440 | G.E. | TS | 600 |
| 125 | 2300 | G.E. | TS | 327 |
| 110 | 440/220 | G.E. | TS | 1800 |
| 100 | 440/220 25 cy. | G.E. | TS | 375 |
| 100 | 440/220 | Whse. | G | 1800 |
| 90 | 440/220 | G.E. | ATI | 1200 |

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1—New 400 Amp. Type FK, 136-132 General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's Pt's, etc.

1—New 2500 amp., DA 75, Whse., 3 pole, air type circuit breaker, indoor

## SQUIRREL CAGE MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 500 | 440/220 | G | K | 1200 |
| 500 | 440/220 | G.E. | IK | 900 |
| 400 | 550 | G.E. | IK | 720 |
| 350 | 440 | G.E. | IK | 900 |
| 300 | 440/220 | G.E. | IK | 720 |
| 200 | 440/220 | Whse. | CS | 600 |
| 200 | 440/220 | G.E. | KT | 600 |
| 200 | 2200/550 | Al. Ch. | AR | 900 |
| 150 | 440/220 | Howell | B. Brg. | 1800 |
| 125 | 2200 | G.E. | KT | 600 |
| 100 | 440 | G.E. | IK | 450 |
| 100 | 2200 | G.E. | KT | 511 |
| 75 | 2200 | G.E | IK | 1800 |
| 74 | 2200 | G.E. | KT | 900 |
| 50 | 2200 | Al. Ch. | | 720 |
| 50 | 550 | Whse. | CS | 3600 |

## A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., G.E.
1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 pm., 440/220 v., G.E.

## MOTOR GENERATOR SETS

1—100 kw., 250 v., 900 rpm. Whse., conn. to 150 hp. 2300 v., 60 cy., sq. cage motor.
1—60 kw., 250 v., 1200 rpm. G. E., conn. to 90 hp. 440/220 v., 60 cy., syn. motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—35 kw., 120 v., 1800 rpm. G.E., conn. to 50 hp. 440/220 v., 60 cy., squirrel cage.

## TRANSFORMERS

60 Cycle

1—150 kva. Whse. SK. 13200-125/215 v. 3 ph.
3—150 kva. G.E. H-K, 2400/4800-240/120 v.
3—150 kva. Whse. SK 11000-2300 v.
3—150 kva. Whse., 11000-2300 volts.
2—100 kva. Whse., SK. 4800/2400-240/120 volts.
3—100 kva. Whse., SK. 2400-120/240/480 v.
3— 50 kva. G.E. DRY, 460-115/230 v.
3—37½ kva. G.E., H-K, 2400-440 volts.
2—37½ kva. Kuhlman, 2400-480 volts, 3 ph., NEW.
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20 H.P.—36"x8'—100# W.P.
15 H.P.—36"x6'6"—100# W.P.
2½ H.P.—20"x3'6"—100# W.P.

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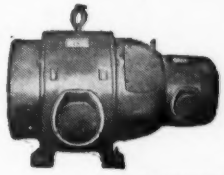

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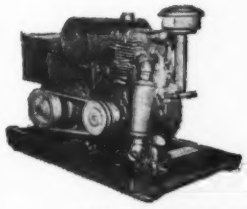

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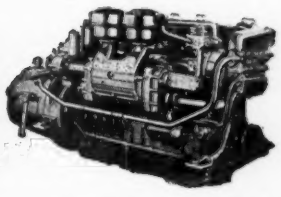

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Complete with Auxiliaries and Control Equipment.
1—3650 KVA 3600 RPM, 2300/3/60, Whse.
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1—150 KW Ridgeway, 900 RPM, 250 V. D.C. to 225 HP. 2300 volt. Syn. complete with control equipment.
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1—200 KVA Kuhlman, Cont. Duty, Auto, 3800-2300/3/60.
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| 2 | 300 | Whse | 1200 | 600 | # |
| 1 | 300 | G.E. | 1200 | 600 | # |
| 1 | 300 | Whse | 1200 | 275 | # |
| 2 | 175 | Whse | 1200 | 275 | 2300/4160 |
| 1 | 175 | G.E. | 1200 | 275 | # |

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## WESTINGHOUSE 625-KVA.

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**Gear:** Size 6¾ x 6, speed 4000/1200 RPM.

**Generator:** 1200 RPM, 3 phase, 60 cycle, 240 volt, with silent chain driven excitor.

**Couplings:** High speed and low speed.

**Baseplate:** Under complete unit.

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300 KW. 3/60/240 V. Non Cond. 150# 5-10# back pr. A-1 immediate delivery.

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## BOILERS

2—UNION Double-Longitudinal drum water tube boilers—406 H.P. each—200 pound pressure, 125 degrees superheat—with Combustion Engineering. Four (4) Retort Fredrick Underfeed Stokers—Diamond Soot Blowers, Cash over furnace draft control, Bailey meters and draft gauges. Can be seen in operation.

**BROWN & BIGELOW**
St. Paul, Minn.

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**3 Edgemoor Wrought Steel, water tube, two horizontal drum, straight tube boilers**
(installed in 1925)

Built to conform to A.S.M.E. code and Pennsylvania State laws, designed for a working pressure of 200# per sq. in. Water wall installed on each boiler in 1931, by the American Engineering Company. Rating of each boiler after installation of water walls—467 H.P. Each boiler complete with a 5 retort 25MC7 Taylor Stoker. These boilers have been insured and regularly inspected by the Hartford Steam Boiler Inspection & Insurance Company. One boiler will be dismantled 7/1/47: balance 12/1/47. Owner will dismantle and boilers sold f.o.b. cars Phila. on an "as-is, where-is" basis

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Four Griscomb-Russell evaporators #147-2-240, style F, horizontal, high pressure, bent tube, self-scaling. Steam working pressure 150# at 80° super heat. Water pressure 100# per square inch gauge. Capacity 80,000# distilled water per hour. Conforms to A. S. M. E. and State of Michigan code, with or without all necessary connecting pipes and valves.

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**COND. TURBO GEN.**

1—Practically new, 2000 KW Westinghouse condensing turbo generator unit with practically all auxiliaries, including condenser, etc., generator air cooler, etc. Turbine Inlet 275#G, Extracting at 5# and 45# Pressure. Generator rated 2500 KVA, 80% P.F., 3 phase, 60 cycle, 480 volts. Details upon request.

FS-291, Power
520 North Michigan Ave., Chicago 11, Ill.

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## DC GENERATORS

100 KW General Electric, 125/250 V. Type RC, 525 RPM, 2 bearing-Switchboard.
75 KW Western Electric, 125/250 V. Type RC-37, 750 RPM, 2 bearing. Both now in service.

**I. J. CROWLEY**
282 Fisher Ave. White Plains, N. Y.

---

## STOKER

One (1) BROWNELL, Type C-150, screw type stoker complete, 5 H.P. AC motor, capacity 750 lbs. p/hr. continuous load, 900 lbs. p/hr. peak load, hopper capacity 1200 lbs. Excellent condition.

**WESTBORO REALTY COMPANY**
565 West End Ave., New York 24, N. Y.

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**FOR SALE**
**ONE DAYTON RAM TYPE**

## BOILER STOKER

Feeding Capacity 950-2400 lbs. per Hour. H.P. 3-10. Never removed from crate. Will sell at a sacrifice.

**THE SIEMON CO.**
State & Dewey Sts. Bridgeport 5, Conn.

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1—21 x 24 Skinner Uniflow steeam engine with 200 KW, GE generator, 2300 volts, excellent condition.
2—66" x 16' E.C. HRT Boilers, 125 lbs. National Board, gas fired, bargain prices.

**McCARTNEY MACHINERY CO.**
Box 35 S. S. Youngstown, Ohio

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**FOR SALE**

1—200 H.P. G.E. Slipring Motor, 3 Ph., 2300 V., 60 Cy., 600 RPM
1—100 H.P. G.E. Slipring Motor, 3 Ph., 440 V., 60 Cy., 1800 RPM

**KEYSTONE ARMATURE WORKS**
1814 Union Ave. Altoona, Pa.

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**7—ALL WOOD BUILDINGS *Complete***

from 308' long to 596' long, all 100 ft wide, clear span x 18 ft high. Phone, wire or write, for full specifications and price.

**BENKART STEEL & SUPPLY CO.**
2017 Preble Avenue Pittsburgh, Pa.

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## WIRE and CABLE
**BOUGHT AND SOLD**

• Substantial quantities of new insulated copper wire in all voltages and almost any constructions now available.

Send us your inquiries or offerings—Lincoln 2958

**UNIVERSAL WIRE and CABLE CO.**
2110-32 No. Racine Ave. Chicago 14, Ill.

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**FOR SALE**

## UNDERFEED SINGLE STOKER

Practically new Combustion Engineering Type E with steam piston 8 ft. x 6 ft. 10". With extension hopper and 72 fire bars both movable and fixed.

FS-293, Power
330 West 42nd St., New York 18, N. Y.

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**MOTORS FOR SALE**

2—50 hp. G. E. 1500 rpm. 3/25/220-440.
1—25 hp. Westinghouse 1500 rpm. 3/25/220-440.
1—5 hp. Wagner 1500 rpm. 3/25/220.
3—½ ton Midget King hoist 3/60/220-440.
2—5 hp. Wagner 1200 rpm. 1/60/110-220.

**WANTED**

2—20 hp. motors 1500 rpm. 3/25/440.

**INDUSTRIAL MOTOR SERVICE**
207 Vandervoort St. N. Tonawanda, N. Y.

6—New Deaerating Heaters, capacities 50,000 to 79,000# per hour.
3—New Surface Condensers, 8200 Sq. Ft.
2—New Surface Condensers, 1500 Sq. Ft.
6—New Surface Condensers, 585 Sq. Ft.
6—New Evaporators, 40 tons per day capacity.
6—Air Ejectors, Twin, 2-stage, New, with inner and after Condensers, for 6000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 4000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 500 KW Turbines.
6—New Westinghouse variable capacity turbine driven Blowers, 19,000 CFM.
12—New Motor Driven Condensate Pumps.
2—New Main Circulating Pumps, 13,000 GPM, 30' Head.
6—New Main Circulating Pumps, 10,500 GPM, 25' Head.
2—1000 KW Slightly Used 3 Ph. 60 Cycl. 440 V. G. E. Condensing Turbines, 400# Pressure.
1—200 KW Slightly Used 3 Ph. 60 Cycl. 440 V. G. E. Condensing Turbine, 400# Pressure.
1—5000 KW G.E., New Turbine Generator.

**SUNDFELT EQUIPMENT COMPANY, INC.**

3422 First Ave. So. Seattle 4, Wash.
MAin 1474

# BOILERS

## Large Stock — Immediate Delivery

### NEW—*High Pressure*

4—Model 12C Cyclotherm Steam Generators comp. with Return System 100# W.P.
1—25 H. P. Steam Generator comp. with Return System 125# W.P.
4—25 H. P. Kewanee Scotch Marine for Oil Firing 100# W.P.
1—32 H. P. Kewanee Firebox Type comp. with Oil Burner, Hand Fired Grates, Stack, Fire Brick, etc. 100# W.P. Packed for Export.
1—53 H.P. Horizontal Return Tubular 150 lbs W.P.
1—80 H. P. Cyclotherm Steam Generator (Light Oil) 125# W.P.
1—80 H. P. Cyclotherm Steam Generator (Heavy Oil) 125# W.P.
1—150 H.P. Horizontal Return Tubular 150 lbs. W.P.
1—150 H. P. Cyclotherm Steam Generator (Heavy Oil) 100# W.P.
2—200 H.P. Union Iron Works Universal for Oil Firing 150# W.P.
1—200 H.P. Scotch Marine 150 lbs. W.P.

### USED—*High Pressure*

1—50 H. P. Fitzgibbons with Shaking Grates 100# W.P.
6—90 H P. Cyclotherm Steam Generators 125# W.P.
2—100 H. P. Titusville Economic Type for Oil or Coal 150# W.P.
2—200 H. P. Keeler HRT ASME 150# W.P. with Oil Burners and Pumping Equipment.
2—200 H. P. Keeler HRT ASME 150# W.P. with New Skelly Stokers.
2—250 H. P. Hine Box Header Water Tube 180# W.P.
2—300 H. P. Oil City (Heine Type) Hand Fired Grates ASME 160# W.P.
1—489 H. P. Heine Water Tube Hand Fired Grates ASME 160# W.P.
2—600 H. P. Springfield Sectional Header ASME 200# W.P.

*We also carry a large stock of Heating Boilers, both NEW and Used for Immediate Delivery.*

***Call—Wire or Write***

**J. PARKER THOMPSON CO., INC.**

**507 Fifth Ave.** ***Murray Hill 7-6547-8-9*** **New York 17, N. Y.**

# BRAND NEW

(1) New Substation, Indoor, Type Electrical transformer, Mfgr. General Electric Co. Consisting of (1) 667 KVA single phase, pyranel filled 4160 V. primary 60 cy. to 2300 V. secondary power transformer, secondary winding having 8 taps equally spaced from 1150 to 2300 V. (1) loose connected electrically operated secondary Air-Circuit Breaker for control. (6) EJ-1 fuses. (1) closing device. (3) sets gaskets. (2) Gal. Pyranol. (3) sets Pothead Acc. (1) transfer truck. (1) test plug. (1) control power transformer. (1) handle. (2) task coupler. (1) ammeter. Bolts, nuts, washers, etc. Packed 1 skid, 4 crates, 1 box. Floor space 6' x 6' x 98 H. Weight 24500#.

INSPECTION AT OUR WAREHOUSE

*No Reasonable Offer Refused*

**WINSTON MACHINERY CO., Inc.**
517 South Delaware Street
Indianapolis, Indiana

# Electric GENERATING UNIT

***Immediate Delivery*** — ***Priced Right***

Used only a short time — Excellent Condition

Westinghouse special-impulse type comp. 540-KW DC 230-V 3000-A 850/1000-rpm variable fan-cooled drip-proof generator ser. #19S13P158 with 1 sleeve bearing, special shaft, sub-base, interval timer & amplidyne control, hydraulic coupled to Cooper-Bessemer 510-HP 900-rpm air-starting 8-cyl. 4-cycle type FS8LH marine Diesel engine, ser. #1808 with modified common rail fuel injection system, pressure lubrication; 19' x 5'8" x 6'8" overall.

MORRIS SEGALL MACHINERY CO.

CONSTITUTION & TERMINAL STS., BALTIMORE 2, MD.
*Lexington 0534*

## DIESEL GENERATOR UNIT

**1500 H.P.—1250 KVA**

Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
Immediate Stock Delivery Rebuilt

**A. G. SCHOONMAKER COMPANY**
50 Church St., New York 7, N. Y.
Phone Worth 2-0455

## DIESEL GENERATOR SET

General Motors Diesel 12 cylinder, model 12/567, 2 cycle, 720 RPM, direct connected to: 600 KW, 500 volt D.C. Westinghouse Generator. Like new, in stock.

**ALJON DIESEL CO., INC.**
904-10 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

## SCOTCH BOILER

60 HP, 125#, new 1941; return pump, high and low water control Ray oil burner and smoke stack.

**F. W. HAY & COMPANY**
2734 Cherry St., Kansas City 8, Mo.

# FOR SALE

## THREE ENGINE GENERATORS with the FOLLOWING SPECIFICATIONS:

ENGINE: Skinner Uniflow Single Cylinder Horizontal Right Hand, 24x20. Speed 200 rpm. Steam 150-S Saturated.

GENERATOR: D.C., General Electric. Type L.D. S10-8-200-200 Form O. Amp. 800. Speed 200. Volts No Load, 125/250. Volts Full Load, 125/250. 200 K.W. Cont'ly 35° C Rise. 25% Ov'l 4 hrs. .50° C Rise.

## ONE ENGINE GENERATOR SET

ENGINE: Skinner Uniflow Single Cylinder Horizontal Right Hand, 24x36. Speed 150 rpm. Steam 150-S Saturated.

GENERATOR: D.C., General Electric. Type LD-14-A. 10. 500-150 Form A. Amp. 2000. Speed 150. Volts No Load, 245 125/250. Volts Full Load, 250 125/250. 500 K.W. Cont'ly 40° C Rise. 25% Overload. 2 hrs. 55° C Rise.

**FS-311,** Power
330 West 42nd St., New York 18, N. Y.

# OPPORTUNITIES!

*in*

*New and used equipment recently released from service by a number of electric and gas utility companies*

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

*Send for new list, . . . to*

**APPARATUS EXCHANGE**
**EBASCO SERVICES INCORPORATED**
Two Rector St. New York 6, N. Y.

# MOTORS—M. G. SETS—CONTROL

**In Stock—Immediate Shipment—Rebuilt & Guaranteed**

## CRANE & MILL MOTORS

**230-V. D.C.**

| Qu. | h.p. | Make | Type | R.P.M. |
|---|---|---|---|---|
| 3 | 5 | G.E. | MD-101 | 825 |
| 2 | 6/7½ | Whse. | MC-20 | 725/625 |
| 1 | 6 | G.E. | CO-1805 | 1150 |
| 1 | *9 | G.E. | MD-102 | 975 |
| 1 | 10 | G.E. | CO-2504 | 700 |
| 1 | 14/19 | Cr. Wh. | B. W. | 675/560 |
| 1 | 19 | Cr. Wh. | S. W. S.-15 | 560 |
| 1 | 21 | G.E. | C. O.-2506 | 540 |
| 1 | 25 | G.E. | COM-1828 | 850 |
| 1 | 30/42 | Cr. Wh. | D. W. | 620/520 |
| 1 | 30/45 | G.E. | MD-104½ | 625/500 |
| 1 | 33 | Cr. Wh. | SWS-25 | 500 |
| 2 | 35 | G.E. | CO-2506 | 650 |
| 1 | *40/50 | G.E. | MD-105 | 550/475 |
| 1 | 50 | G.E. | CO-1829 | 750 |
| 2 | *50 | G.E. | COM-1830 | 525 |
| 1 | 50 | G.E. | CO-1830 | 525 |
| 1 | 54/80 | Cr. Wh. | F. W. | 575/480 |
| 2 | 65 | G.E. | CO-1830 | 700 |
| 5 | 65/85 | G.E. | CO-1841 | 600/550 |
| 1 | 70/90 | Whse. | MCA-70 | 450 |
| 1 | 75/85 | G.E. | MD-106 | 500/460 |
| 3 | 85/110 | G.E. | MD-107 | 500/450 |
| 2 | 100 | G.E. | CO-1812 | 600 |
| 1 | *100/140 | G.E. | MD-108 | 500/430 |
| 1 | 100/140 | G.E. | MD-108 | 500/430 |
| 1 | | Whse. | MTA #2 | |

All above series except * compound wound.

### MOTOR GENERATOR SETS

1—10 KW, 250-VDC., 1800-RPM., Sq. Cg. Motor, 220/3/60-Cy.

1—175 KW, 250-VDC., Comp. Interpole, 1200-RPM., 260-HP. G.E. syn. motor, 4100/2200/3/60-Cy., complete with A.C. and D.C. panels and starting equipment.

1—3-Unit Set, (2) 70 KW, 40-VDC. Generators, (1) 210-HP. Westghse. Syn. Motor, 440/3/60-Cy., complete with A.C. and D.C. panels and control equipment.

## ADJUSTABLE SPEED MOTORS

| Qu. | H.P. | Make | Type | R.P.M. |
|---|---|---|---|---|
| 1 | ¾ | G.E. | B.D.-225 | 600/1800 |
| 1 | 2 | G.E. | R.F.-7 | 500/2000 |
| 1 | 2 | G.E. | C.D.-55 | 700/2100 |
| 1 | 3½ | Whse. | S.K.-30 | 660/2000 |
| 1 | 3 | Rel. | T-14 | 1200/3600 |
| 1 | 5 | G.E. | R.F.-9 | 450/1350 |
| 1 | 5 | Whse. | SK-33 | 1150/1650 |
| 1 | 6 | G.E. | R.F.-9 | 450/1350 |
| 1 | 7½ | G.E. | R.F.-10 | 450/1350 |
| 1 | 7½ | G.E. | R.F.-10 | 450/1800 |
| 1 | 7½ | Rel. | T-78 | 500/1500 |
| 1 | 7½ | G.E. | C.D.-75 | 600/1800 |
| 1 | 7½ | Whse. | SK-70 | 600/1800 |
| 1 | 7½ | Whse. | SK-60-L | 650/1300 |
| 1 | 8 | Whse. | SK-100-L | 300/1200 |
| 1 | 8½ | G.E. | R.F.-9 | 600/1800 |
| 2 | 9 | G.E. | R.F.-10 | 400/1600 |
| 1 | 10 | Whse. | S.K. | 250/1000 |
| 1 | 10 | G.E. | R.F.-12 | 300/1200 |
| 3 | 10 | Whse. | SK-90 | 400/1600 |
| 1 | 10/15 | Al. Ch. | E.B.-100 | 575/1725 |
| 3 | 15 | G.E. | R.F.-11 | 400/1600 |
| 1 | 15 | El. Dy. | 10-S | 450/1350 |
| 3 | 15 | G.E. | RF-10 | 550/1650 |
| 1 | 15 | El. Dy. | 5-S | 600/1200 |
| 1 | 19 | Whse. | SK-100-L | 600/1200 |
| 1 | 20 | G.E. | RF-12 | 400/1600 |
| 1 | 25 | G.E. | C.D.-128 | 200/800 |
| 1 | 25 | G.E. | R.F.-13 | 400/1200 |
| 1 | 25 | Rel. | T-262 | 500/1500 |
| 1 | 25 | G.E. | RF-11 | 500/1500 |
| 2 | 27½ | El. Dy. | | 450/1350 |
| 1 | 30 | G.E. | C.D.M-105 | 875/1750 |
| 1 | 32½ | Whse. | SK-150 | 400/1200 |
| 1 | 35 | G.E. | RF-14 | 250/1000 |
| 1 | 35/50 | Whse. | SK-160 | 500/750 |
| 1 | 50 | Whse. | SK | 250/1000 |
| 1 | 50/65 | El. Dy. | 30-S | 300/1200 |
| 1 | 60 | Whse. | SK-131 | 500/1500 |
| 1 | 100 | Rel. | T-1050 | 400/1200 |
| 1 | 150/185 | El. Dy. | 75-S | 250/500 |
| 1 | 200/250 | Rel. | 2600-T | 400/800 |

WE CAN SUPPLY WITH THE ABOVE ADJUSTABLE & CONSTANT SPEED MOTORS—Manual—Semi magnetic and manual and fully magnetic AUTOMATIC CONTROL "ENGINEERED TO YOUR SPECIFICATIONS."

## SQUIRREL CAGE MOTORS

**3-Phase 60-Cycle**

| Qu. | H.P. | Make | Type | Volts | R.P.M. |
|---|---|---|---|---|---|
| 1 | 20 | G.E. | I-K | 220 | 565 |
| 1 | 25 | G.E. | I-K | 220 | 600 |
| 1 | 25 | Whse. | CS-567 | 220 | 1160 |
| 1 | 25 | Cent. | AS-30 | 550 | 1155 |
| 1 | 25 | Al. Ch. | | 550 | 1740 |
| 1 | 25 | Burke | | 550 | 1800 |
| 6 | 50 | Whse. | CS | 220 | 900 |
| 1 | 75 | G.E. | I-K | 220 | 1800 |
| 3 | 75 | Cr. Wh. | Q-230 | 440 | 690 |
| 1 | 150 | G.E. | I-K | 440 | 900 |
| 1 | 200 | G.E. | KT-357 | 4600 | 1750 |
| 1 | 200 | G.E. | KT-357 | 2200 | 1750 |

2—20-HP. Westinghouse CS-364Y gear motors, 220/440-V., 3-Ph., 60-Cy., Class I, TE, BB, fan-cooled, 68-RPM.

## SLIP RING MOTORS CONSTANT DUTY

**3-Phase 60-Cycle**

| Qu. | H.P. | Make | Type | Volts | R.P.M. |
|---|---|---|---|---|---|
| 1 | 10 | G.E. | I-M | 220 | 1120 |
| 1 | 10 | G.E. | I-M | 550 | 1150 |
| 1 | 10 | Whse. | CW | 440 | 900 |
| 1 | 20 | G.E. | MT-326 | 220 | 900 |
| 2 | 25 | G.E. | MT-332 | 2200 | 850 |
| 2 | 25 | G.E. | MT-332 | 550 | 900 |
| 1 | 30 | Al. Ch. | ANY | 440 | 900 |
| 1 | 40 | Al. Ch. | ANY | 2200 | 435 |
| 1 | 40 | Al. Ch. | ANY | 550 | 450 |
| 1 | 40 | Whse. | CW | 2200 | 1800 |
| 3 | 40 | G.E. | I-M | 600 | 1170 |
| 1 | 50 | Whse. | CW | 2200 | 1800 |
| 1 | 125 | Wag. | BR | 2200 | 1160 |
| 1 | 200 | G.E. | I-M | 2200 | 450 |
| 1 | 250 | G.E. | MT | 2200 | 900 |
| 1 | 300 | Whse. | CW-3 | 2200 | 585 |
| 1 | 300 | Al. Ch. | ANY | 2200 | 514 |
| 1 | 350 | Al. Ch. | ANY | 2200 | 514 |
| 1 | 400 | Whse. | CW-1108 | 2200 | 514 |
| 1 | 400 | G.E. | MT-412 | 440 | 600 |
| 1 | 500 | Al. Ch. | ANY | 440 | 600 |

(Manual or Magnetic Control for starting duty, or reversing or varying speed, can be supplied ENGINEERED TO YOUR SPECIFICATIONS)

## T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

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**FOR SALE**

# Diesel Driven A. C. Generators

**Immediate Delivery Excellent Condition**

1—WESTINGHOUSE SYNCHRONOUS GENERATOR. SERIAL NO. 4938528 TYPE ES, 219 KVA, 3/60/2400 V. 80% POWER FACTOR, DIRECT CONNECTED TO: CHICAGO PNEUMATIC DIESEL ENGINE, 240 HP, TYPE RH 40, 327 RPM.

Unit complete with: Switchboard, Exciter, Oil Clarifier, Starting Air Compressor, Pumps, Piping and Fuel Tank.

1—FAIRBANKS MORSE SYNCHRONOUS GENERATOR, SERIAL NO. 263163 200 KVA, 3/60/2400 V. 100% POWER FACTOR.

DIRECT CONNECTED TO: FAIRBANKS MORSE DIESEL ENGINE, MODEL NO. 32, 240 HP, 4 CY. 257 RPM.

UNIT COMPLETE WITH: SWITCHBOARD, EXCITER, OIL CLARIFIER, STARTING AIR COMPRESSOR, PUMPS, PIPING AND FUEL TANK.

WRITE, WIRE, PHONE

## INDUSTRIAL PLANTS CORPORATION

90 W. Broadway, New York City (7) BAarclay 7-4185

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**FOR SALE**

## CENTRIFUGAL PUMPS & MOTORS

***LIKE NEW***

1—DeLaval Centrifugal Dual Motor Pump: capacity 19,500 GPM @ 400 RPM 32' head. 25,000 GPM @ 514 RPM 50' head. Equipped with 200 and 400 H.P. 6900 V. 60 cy. Electric Machinery Company Synchronous Motors.

2—DeLaval Centrifugal Pump Units: capacity 15,200 GPM @ 600 RPM 68' head. Each equipped with 300 HP, 6900 V. 60 cy. Syn. E-M Co. Motors.

Westinghouse Metal Clad Switchgear and Simplex Discharge Meters available with above equipment. These pumps installed new in 1938 and operated only for few hours testing.

## BOILER - STOKER - FURNACE

1—B&W 4 Drum Sterling Boiler, 7000 sq. ft. operating capacity 250 psi, 45,000 #/hr continuous.

Taylor water cooled stoker, 6 retort underfeed, 125 sq. ft. grate surface, steam ash dump.

Furnace has water cooled front and bridge walls, Bernitz Carborundum sidewalls, Diamont Soot blowers, Bailey controls and gages.

This equipment in good condition, installed 1939, intermittently used only 3 years.

All above equipment may be inspected at any time. More details gladly furnished upon request.

**CITY OF TOLEDO — DIVISION OF WATER**

565 Erie Street — Toledo 4, Ohio

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**FOR SALE**

## NEW MOTORS

44—G.E. & Crocker-Wheeler 50 H.P. New D.C. Motors, Slow Speed, Fully Enclosed, Double End Tapered Shafts.

**CENTRAL PIPE & SUPPLY CO.**

2109 No. Broadway — St. Louis 6, Mo.

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**FOR SALE**

## CLIMAX AIR COMPRESSOR

Size 10 x 10 x 10, steam driven, single quarter box, with Meyers valve gear and unloading device.

FS-294, Power
330 West 42nd St., New York 18, N. Y.

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## FOR SALE—GENERATOR

General Motors Diesel, 2 cycles 8 cylinders, BHP 500. Generator Set by Westinghouse, 540 KW., 180 volts, D.C. 3,000 amp. Like new in operation 700 hours. Less than Half Price.

**E. J. TOCK**

957-72nd Street, Brooklyn, N. Y.
Phone Shore Road 5-8090

## DIESELS

1—Buda 6—1879 cu. in. 6¾ bore x 8¾ stroke 200 H.P. Power Unit.

1—Buda 6—468 cu. in. 4¼ x 5½ 70 H.P. Power Unit.

1—Caterpillar D—13000, 6 cyl., 5¾ bore x 8" stroke, 110 H.P. Continuous Output.

**F. L. CUSAC & ASSOCIATES**
Board of Trade Building
Wabash 5860
CHICAGO 4, ILL.

## POWER EQUIPMENT

800 GPM Marley Cooling Tower New Worthington 200 GPM Pump and Turbine. 95 ft. 3 ply 52" Leather Belt.

**THE J. C. LYSLE MILLING CO.**
Leavenworth, Kansas

### UNDERFEED STOKERS

4—Combustion Engineering Co. Underfeed Stokers, Type E, complete with cast iron boiler front and extension hopper having a capacity of 2,500# coal. Stoker width at grate line 12'-7", length 10'-4", grate area 130.03 sq. ft. Two stokers are new, never installed. Two are used. For details and price write U. S. Industrial Chemicals, Inc. Engineering Department, P. O. Box 1797, Baltimore 3, Md.

### STEAM GENERATOR FOR SALE

1—70 H.P. Ames Oil fired Steam Generator completely automatic, built in accordance with ASME code requirements for 150 lbs. steam working pressure. Including feed water pump valves, gages, thermometers, etc., etc.

USED ONLY FOR SHORT WHILE
**LOTTE CHEMICAL COMPANY, INC.**
P. O. Box 2488 Paterson, New Jersey

FOR SALE
### STEAM ENGINE

500 HP Steam Engine, 20 x 42", single cylinder 150#, 100 RPM, complete with 16' flywheel, on original foundation, in good condition.

FS-315, Power
330 West 42nd Street, New York 18, N. Y.

## BOILERS

Two 125 H. P. Babcock Wilcox water tube Boilers 170 tubes 3¼". Will sell cheap

**GORDON'S**
678 Henry St. Detroit, 1, Mich.

*If you don't see what you want . . . ask for it*

If you don't see the equipment advertised that you want, ask for it—ask the advertisers—or we will gladly ask them for you.

*Classified Advertising Division*
POWER

*A Battery-operated*

## INSULATION TESTER!!

## 200 MEGOHMS

At a Test Potential of

## 500 VOLTS D. C.

Supplied by built-in battery and vibrator power supply.

**RANGES—**
0-20 and 0-200 Megohms, full scale
0- .5 and 0-5 Megohms, Center scale

This unit was designed for the Navy to operate off eight 67½ volt batteries which provided a test potential of 350 to 500 Volts.

The original units have been modified slightly to operate off 2 inexpensive, (approximately 80¢) internal #6 standard 1½ volt dry cells and a vibrator power supply which provides a test potential of 500 volts. The use of the vibrator power supply eliminates the high replacement costs (approximately $18.00) of the 67½ volt batteries.

- **NO HAND CRANKING**—The 500 volt potential is made instantly available by simply pressing a panel switch.
- **DIRECT READING**—All calibrations printed in large easy-to-read type enabling exact determination of leakages from 0 to 200 megohms.
- **PORTABLE**—Enclosed in a rugged hardwood carrying case 8⅜" x 9⅛" x 8" deep with removable cover.
- **METER MOVEMENT**—A Weston Model 801 4½" Rect. 0-50 microampere meter guarantees extremely accurate readings on all ranges.

**SURPLUS — NEW — GUARANTEED**

*Complete with leads, instructions, internal power supply, etc. Ready to use.*

**NET $39.50**

All prices F.O.B., N. Y.—25% Deposit required on C.O.D.'s. Orders accepted from rated concerns on open account Net 30 days.

## MARITIME SWITCHBOARD

338 Canal Street - Worth 4-8217 - New York 13, New York

# ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues


Air Preheater Corp. ..... *
Air Transport Ass'n of America for Railway Express Agency ..... 160
Ajax Flexible Coupling Co. ..... 204
Alco Products Div. ..... *
Aldrich Pump Co. ..... 214
Allen-Sherman-Hoff Co. ..... Second Cover
Allis Chalmers Mfg. Co. ..... 39, 42
Alloy Steel Products Co. ..... 234
Allpax Co. ..... 174
American Blower Co. ..... 256
American Brass Co. ..... 125
American Chain & Cable Co. ..... 201
American Chimney Corp. ..... 300
American Coal Burner Co. ..... *
American District Steam Co. ..... 184
American Engineering Co. ..... 34, 55
American K.A.T. Corp. ..... *
American Locomotive Co. ..... *
American Manganese Steel Div. ..... 259
American Metal Hose Branch ..... *
American Pulverizer Co. ..... 159
Ames Iron Works ..... *
Anchor Packing Co. ..... 177
Anderson Co., V. D. ..... 145
Arkansas Fuel Oil Co. ..... *
Armstrong Cork Co. ..... 226
Armstrong Machine Works ..... 43
Asbestos, Textile & Packing Div. Raybestos, Manhattan, Inc. ..... *
Atlas Valve Co. ..... 178
Automatic Control Co. ..... 196

Babbitt Steam Specialty Co. ..... 200
Babcock & Wilcox Co. ..... 4-5
Babcock & Wilcox Tube Co. ..... 157
Badger & Sons Co., E. B. ..... *
Bailey Meter Co. ..... 10-11
Baldwin-Hill Co. ..... 247
Baldwin Locomotive Works ..... 228
Bartlett Hayward Div (Koppers Co...) *
Bartlett & Snow Co., C. O. ..... 238
Beaumont-Birch Co. ..... *
Bell & Gossett Co. ..... *
Belmont Packing & Rubber Co. ..... 168
Besler Corp. ..... *
Betz Co., W. H. & L. D. ..... 251
Biddle Co., James G. ..... 162
Birch Mfg. Co. ..... 300
Bird-Archer Co. ..... 297
Black, Sivalls & Bryson Co. ..... 286
Blaw-Knox Co. ..... *
Boiler Tube Co. of America ..... 303
Brickseal Refractory Co. ..... *
Bridgeport Brass Co. ..... 301
Brooke Engrg Co. ..... 192
Bros Boiler & Mfg. Co., Wm. ..... 163
Brown Instrument Co. ..... 272
Brunt Equipment Co. ..... *
Buell Engrg Co. ..... *
Buffalo Forge Co. ..... 31
Buffalo Pumps, Inc. ..... 147
Burke Electric Co. ..... *
Bussmann Mfg. Co. ..... *
Byers Co., A. M. ..... 62
Byron Jackson Co. ..... 271

Cabot, Inc., Samuel ..... *
Canton Stoker Co. ..... 263
Carbide & Carbon Chemicals Corp. ..... 300
Carborundum Co. ..... 254
Cardox Corp. ..... *
Cash Co., A. W. ..... 274
Cash Valve Mfg. Corp., A. W. ..... 298
Chapman Valve Mfg. Co. ..... 141
Chase Brass & Copper Co. ..... 54, 187
Chicago Metal Hose Corp. ..... 252
Chicago Pneumatic Tool Co. ..... 235
Cities Service Oil Co. ..... *
Clarage Fan Co. ..... *
Clark Mfg. Co. ..... *
Cleaver-Brooks Co. ..... 258
Coats Machine Tool Co. ..... *
Cochrane Corp. ..... 206
Coffin Jr. Co., J. S. ..... 171
Combustion Engrg Co. ..... 44-45
Condenser Service & Engrg Co. ..... 40-41
Consolidated Edison Co. ..... 284
Coppus Engrg Co. ..... 207
Corning Glass Works ..... 174
Crane Co. ..... 127
Cryer Trap & Valve Co. ..... *
Cutler-Hammer, Inc. ..... 115
Cyclotherm Corp. ..... 161

Dampney Co. of America ..... 148
Darling Valve & Mfg. Co. ..... *
Dart Mfg. Co., E. M. ..... 210
Davis Engrg Co. ..... *
Davis Regulator Co. ..... *
Dayton Rubber & Mfg. Co. ..... 257
Dearborn Chemical Co. ..... 203
De Laval Separator Co. ..... 273
De Laval Steam Turbin Co. ..... 58, 200, 240
Deming Co. ..... *
Detroit Stoker Co. ..... *
Diamond Power Specialty Corp. ..... 8-9
Dings Magnetic Separator Co. ..... *
Dodge Mfg. Corp. ..... *
Dominion Chemical Co. ..... *
Dowell, Inc. ..... 209
Dravo Corp. ..... 139
Drew & Co., E. F. ..... 260
du Mont Corp. ..... 212
Dunham Co., C. A. ..... *

Eagle Pitcher Co. ..... *
Edge Moor Iron Works, Inc. ..... 227
Edward Valves, Inc. ..... 121
Electric Fish Screen Co. ..... *
Electric Machinery Mfg. Co. ..... *
Electric Storage Battery Co. ..... 262
Elgin Softener Corp. ..... 215
Elliott Co. ..... 6-7
Engineer Co. ..... *
Enterprise Engine & Foundry Co. ..... 280
Ernst Water Column & Gage Co. ..... 293

Fairbanks, Morse & Co. ..... 233
Fairfield Engrg Co. ..... 342
Fairmont Coal Bureau ..... *
Flexitallic Gasket Co. ..... 180
Flexo Supply Co. ..... *
Flexrock Co. ..... *
Foster Engineering Co. ..... 276
Foster Wheeler Corp. ..... 16-17
Foxboro Co. ..... 199
Frick Co. ..... 198
Fuller Co. ..... *
Fyr-Feeder Spreader Stoker ..... *

Gardner Denver Co. ..... *
Garlock Packing Co. ..... 222
General Coal Co. ..... 156
General Controls Co. ..... 286
General Electric Co. (Apparatus Dept) ..... 20-21, 52-53, 143
General Electric Co. (Appliance & Merch. Dept) ..... 183
Gifford-Wood Co. ..... *
Gilmer Div., L. H. of U. S. Rubber Co. .. *
Globe Steel Tubes Co. ..... 248
Golden-Anderson Valve Specialty Co. ... 241
Goodyear Tire & Rubber Co. ..... 47
Goulds Pumps, Inc. ..... *
Green Fire Brick Co., A. P. ..... *
Greene, Tweed & Co ..... *
Grinnell Co. ..... 3rd Cover
Griscom-Russell Co. ..... 245
Gulf Oil Corp. ..... 253
Gulf Refining Co. ..... 253
Gunite Concrete & Const Co. ..... 188

Haering & Co., D. W. ..... *
Hagan Corp. ..... 48-49
Hahn Equipment Corp. ..... 296
Hall Laboratories ..... 28-29
Haynes Stellite Co. ..... *
Hays Corp. ..... *
Hays Institute of Combustion ..... 212
Heacon, Inc. ..... 268
Helicoid Gage Div. American Chain & Cable Co. ..... 146
Hendrick Mfg. Co. ..... *
Henszey Mfg. Co. ..... *
Hercules Float Works ..... *
Hewitt Rubber of Buffalo Div. of Hewitt-Robins, Inc. ..... 191
Hill Pump Valve Co. ..... *
Hoffman Specialty Co. ..... *
Homestead Valve & Mfg. Co. ..... 267
Honan-Crane Corp. ..... 295
Hoppes Mfg. Co. ..... 293

Illinois Water Treatment Co. ..... 158
Infilco, Inc. ..... *
Ingersoll-Rand Co. ..... 236
Inland Steel Co. ..... *
International Cementers, Inc. ..... *
International Nickel Co. ..... 36, 155
Iron Fireman Mfg. Co. ..... *

Jefferson Union Co. ..... 190
Jeffrey Mfg. Co. ..... 217
Jenkins Bros. ..... 132-133
Jerguson Gage & Valve Co. ..... 284
Johns-Manville, Inc. ..... 137
Johnson Corp. ..... *
Jones Foundry & Machine Co., W. A. ... 290
Joy Mfg. Co., (La-Del Div) ..... *
Joy Mfg. Co. (Sullivan Div) ..... 270

Keasbey & Mattison Co. ..... 239
Kellogg Co., M. W. ..... 266
Kennedy Valve Mfg. Co. ..... 250
Kennedy Van Saun Mfg. & Engrg Corp. 14-15
Kewanee Boiler Corp. ..... *
Kieley & Mueller, Inc. ..... *
Koppers Co. ..... *
Kuljian Corp. ..... *

Ladish Co. ..... 169, 284
Laminated Shim Co. ..... 166
Leeds & Northrup Co. ..... *
Leslie Co. ..... 296
Lincoln Electric Co. ..... 291
Linde Air Products Co. ..... 193
Link-Belt Co. ..... 3
Liquid Conditioning Corp. ..... 246
Liquidometer Corp. ..... *
Lovejoy Flexible Coupling Co. ..... 188
Lubriplate Div. Fiske Bros. Refining Co. 186
Lummus Co. ..... *
Lumnite Div. Univ. Atlas Cement Co. .. 216
Lunkenheimer Co. ..... 38-39

Madden Co., P. E. ..... 190
Manhattan Rubber Div. Raybestos, Manhattan, Inc. ..... 219
Manheim Mfg. & Belting Co. ..... 237
Manning, Maxwell & Moore ..... 303
Manzel Brothers Co. ..... *
Marion, Machine Foundry & Supply Co. 296
Marley Co. ..... 299
Marlow Pumps, Inc. ..... 292
Marsh Corp., James P. ..... *
Mason-Neilan Regulator Co. ..... *
McGraw-Hill Book Co. ..... 294
Mercoid Corp. ..... 210
Midwest Piping & Supply Co. ..... 255
Minneapolis-Honeywell Regulator Co. ..... *
Modine Mfg. Co. ..... *
Mortell Co., J. W. ..... 188
Murray Iron Works Co. ..... 150

National Airoil Burner Co. ..... 288
National Aluminate Corp. ..... 131
National Supply Co. ..... *
National Tube Co. ..... *
National Valve & Mfg. Co. ..... 278
Niagara Blower Co. ..... *
Nicholson Co., W. H. ..... 196
Nordberg Mfg. Co. ..... 285
Northern Equipment Co. ..... 135
Norton Co. ..... 277
Nutmeg Chemical Co. ..... 200

Oakite Products Inc. ..... 194
Ohio Injector Co. ..... *
Orr & Semblower Inc. ..... *
Otis Elevator Co. ..... 224
Ozalid Div. of General Aniline & Film Corp. ..... 123

Pacific Pumps, Inc. ..... 265
Parker Appliance Co. ..... *
Peerless Pump Div. ..... 208
Penflex Sales Co. ..... 264
Penn. Salt Mfg. Co. ..... 225
Permutit Co. ..... 175, 212
Philadelphia Gear Works ..... 195
Pipe Fabrication Institute ..... 275
Pittsburgh Piping & Equipment Co. ..... 289
Powell Co., Wm. ..... 56, 57
Powers Regulator Co. ..... 194
Prat-Daniel Corp. ..... *
Preferred Utilities Mfg. Corp. ..... 249
Pritchard Co., J. F. ..... *

Quaker Rubber Corp. ..... 288

Raybestos Manhattan, Inc. ..... 219
Reading, Pratt & Cady Div. ..... 201
Reeves Pulley Co. ..... *
Reliance Electric & Engrg. ..... 229
Reliance Gauge Column Co. ..... 35
Republic Flow Meters Co. ..... 24-25
Republic Rubber Div. Lee Tire & Rubber Corp. ..... 261
Republic Steel Co. ..... 26-27
Research Corp. ..... 242
Revere Copper & Brass, Inc. ..... 129
Richardson Scale Co. ..... *
Ric-Wil Co. ..... 231
Ridge Tool Co. ..... 292, 293
Riley Stoker Corp. ..... 96-97
Robins Conveyors, Inc. Div. Of Hewitt Robins, Inc. ..... 191
Rockbestos Products Corp. ..... 244
Roebling's Sons Co., J. A. ..... 179
Roper Corp., Geo. D. ..... *
Roto Div., Elliott Co. ..... 232
Rust-Oleum Corp. ..... 286

Sarco Co. ..... 173
Sauerman Bros., Inc. ..... *
Schramm, Inc. ..... 140
Schutte & Koerting Co. ..... 269
Scovill Mfg. Co. ..... 32-33
Shaw Co., B. F. ..... 185
Sier-Bath Gear & Pump Co. ..... 182
Simplex Valve & Meter Co. ..... *
Sinclair Refining Co. ..... 197
Skinner Engine Co. ..... *
Sloan Valve Co. ..... 170
Smith Refractories, Sanford C. ..... 300
Smooth-On Mfg. Co. ..... 298
Socony-Vacuum Oil Co. ..... Back Cover
Sprague Electric Co. ..... 208
Springfield Boiler Co. ..... *
Square D Co. ..... 181
Squires Co., C. E. ..... 292
Standard Oil Co. of Calif. ..... 211
Standard Oil Co. of Indiana ..... 151-152
Standard Pressed Steel Co. ..... 212
Steel & Tubes Div. ..... 26-27
Stephens-Adamson Mfg. Co. ..... 279
Sterling Mfg. & Engrg Corp. ..... *
Stickle Steam Specialties Co. ..... 164
Stock Engrg Co. ..... 202
Stone & Webster Engrg Co. ..... 221
Strong Carlisle & Hammond Co. ..... 176
Struthers Wells Corp. ..... 283
Sturtevant Co., B. F. ..... 22-23
Sun Oil Co. ..... 119
Superior Combustion Industries ..... 287
Superior Engine Div. ..... *
Syntron Co. ..... *

Taylor & Co., W. A. ..... *
Taylor Forge & Pipe Works ..... 223
Taylor Instrument Co's ..... *
Templeton Bros. ..... *
Terry Steam Turbine Co. ..... 243
Texas Co. ..... 12-13
Thermix Corp. ..... 268
Tidewater Associated Oil Co. ..... *
Timken Roller Bearing Co. ..... 205
Todd Shipyards Corp. Combustion Equipment Div. ..... 218
Toledo Pipe Threading Machine Co. ..... *
Trane Co. ..... *
Troy Engine & Machine Co. ..... 172
Tube Turns, Inc. ..... *

Union Carbide & Carbon Corp. ..... 193, 300
Union Iron Works ..... 213
U. S. Steel Corp. ..... *

Viking Pump Co. ..... 198
Vogt Machine Co., Henry ..... 50-51

Waldron Corp., John ..... 186
Wallace & Tiernan Products, Inc. ..... *
Walworth Co. ..... 167
Warren Steam Pump Co. ..... 37
Watson-Stillman Co. ..... 281
Webster & Co., Warren ..... *
Western Chemical Co. ..... 294
Westinghouse Electric Corp. ..... 60-61
Weston Electrical Instrument Corp. ..... *
Wheeler Mfg. Co., C. H. ..... 153
Where To Buy ..... 300
Wickes Boiler Co. ..... 230
Wiedeke Co., Gustav ..... 300
Williams Gauge Co. ..... 142
Williams & Co., J. H. ..... 298
Wilson, Inc., Thomas C. ..... 220
Worthington Pump & Machinery Corp. ..... 46, 149, 189
Wright-Austin Co. ..... *
Wrigley, Jr., Co., Wm. ..... *

Xxit Sales Co. ..... 204

Yarnall-Waring Co. ..... 18-19, 117, 154
York-Shipley Inc. ..... *
Youngstown Sheet & Tube Co. ..... 165

Zallea Bros. & Johnson ..... 144
Zernickow Co., O. ..... 300



**PROFESSIONAL SERVICES** ..... 302


## SEARCHLIGHT SECTION


CLASSIFICATION Page
EMPLOYMENT ..... 305
POSITIONS VACANT ..... 305
POSITIONS WANTED ..... 305
SELLING OPPORTUNITIES ..... 305
WANTED TO PURCHASE ..... 306
USED EQUIPMENT ..... 306-339
Aljon Diesel Co., Inc. ..... 337
American Air Compressor Corp. ..... 330
Atlantic Transformer Co. ..... 333
Bauer, L. W. ..... 306
Belyea Co., Inc. ..... 308
Benkart Steel & Supply Co. ..... 336
Benjamin's For Motors ..... 330, 335
Berger Bros. Elec. Motors Inc. ..... 334
Brearley, H. P. ..... 331
Brew, Woltman & Co., Inc. ..... 324
Brown & Bigelow ..... 336
Castle, James T. ..... 330
Central Pipe & Supply Co. ..... 338
Chicago Electric Co. ..... 326
Cohen Pump & Machinery Co., Lou .. 330, 334
Consolidated Products Co. ..... 332
Crowley, I. J. ..... 336
Cusac & Associates, F. L. ..... 339
Delta Equipment Co. ..... 333
Diesel Motors Corp ..... 315, 316, 317
Douglas Co., Stephen ..... 336
Duquesne Electric & Mfg. Co. ..... 327
Ebasco Services Inc. ..... 337
Economy Co, Inc. ..... 332
Electric Apparatus Repair Co. ..... 334
Electric Equipment Co. ..... 332
Electric Generator & Motor Co. ..... 331
Electric Service Co., Inc. ..... 306
Ellis Co., A. Lee ..... 324
Erie Electric Co., Inc. ..... 327
Evans Products Co. ..... 306
Fletcher Sales Co. ..... 332
General Machinery Ltd. ..... 328
General Machinery & Equipment Co. Inc. . 334
Glow-Electric Co. ..... 319
Gorden's ..... 339
Great Lakes Pipe Line Co. ..... 335
Guyan Machinery ..... 332
H & P Machinery Co. ..... 324
Hall & Co., Stephen ..... 333
Hay & Co., F. W. ..... 337
Heat & Power Co., Inc. ..... 314
Hemphill & Co., Inc., J. L. ..... 307
Howe Brothers ..... 333
Industrial Motor Service ..... 336
Industrial Plants Corp. ..... 338
International Power Machinery Co. ..... 309
Iron Oxide Corp., The ..... 306
Johnson & Associates, Howard Blaine .... 332
Keystone Armature Works ..... 336
Keystone Power Plant Equipment Co. .... 330
Kiemle Co., Fred W. ..... 330
Kirk Co, Wallace E. ..... 324
Klauder & Associates, Louis T. ..... 306
Land & Co., L. J. ..... 310
Locke Co., C. B. ..... 335
Lotte Chemical Co., Inc. ..... 339
Lysle Milling Co., J. C., The ..... 339
MacCabe Co., T. B. ..... 338
McCartney Machinery Co. ..... 336
Mack Molding Co., Inc. ..... 306
Maritime Switchboard ..... 339
Metropolitan Plumbing Supply Co. ..... 331, 333
Midwest Mfg. Co. ..... 336
Mississippi Valley Equipment Co. ..... 331
Motor Power Co. of N. Y. Inc. ..... 334
Neu Corp., Hugo ..... 322
New York Air Brake Co., The ..... 306
Penn Machinery Co. ..... 335
Philadelphia Transformer Co. ..... 331, 333
Power Equipment Co. ..... 306
Power Plant Equipment Co., Inc ..... 335
Rearick, Charles B. ..... 331
Rome & Associates, Inc., Thomas 318, 325, 329
Schoonmaker, Co., Inc., A. G. .. 320, 321, 337
Segall Machinery Co., Morris ..... 337
Siemon Co., The ..... 336
Skinner Machinery Co. ..... 335
Stanhope, L. M. ..... 334
Stewart & Co., Inc., Paul ..... 313
Sundfelt Equipment Co. ..... 337
Tarentum Products Corp. ..... 328
Taylor Instrument Co ..... 336
Tock, E. J. ..... 338
Thompson Co., Inc., J. Parker ..... 334, 337
Toledo, City of ..... 338
United Distillers of America Inc. ..... 336
Universal Wire & Cable Co. ..... 336
U. S. Industrial Chemicals Inc. ..... 339
Utilities Electrical Machinery Corp. ..... 312
Volland Electric Equipment Co., Inc. .... 329
Wagner & Co., Arthur ..... 326
Weaver & Co., Charles ..... 323, 326
Wente Electric Co. ..... 311
Westboro Realty Co. ..... 336
Wilms & Co., Walter H. ..... 332
Winston Machinery Co., Inc. ..... 337
Wurth Electric Motor Co ..... 334
Zenith Transformer Co. ..... 306

# FAIRFIELD
## coal handling system

One of the most efficient and dependable methods of handling coal is the Fairfield skip hoist.

Shown is a 60 cu. ft. skip hoist with a 91 ft. lift, elevating the coal to hoppered bottom coal bunkers inside the plant. The system has a capacity of 50 tons per hour.

At the skip discharge the coal is passed over a magnetic belt feeder which removes tramp iron. The coal is then distributed to the bunkers by a double strand roller flight conveyor. It is then weighed as used and delivered to the pulverizers.

This installation was designed—built—erected by Fairfield to meet the specific needs of this plant.

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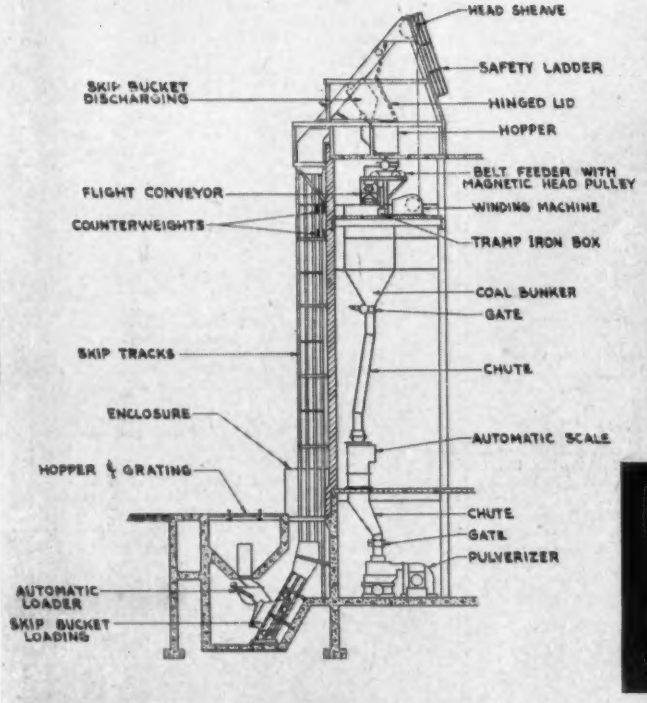
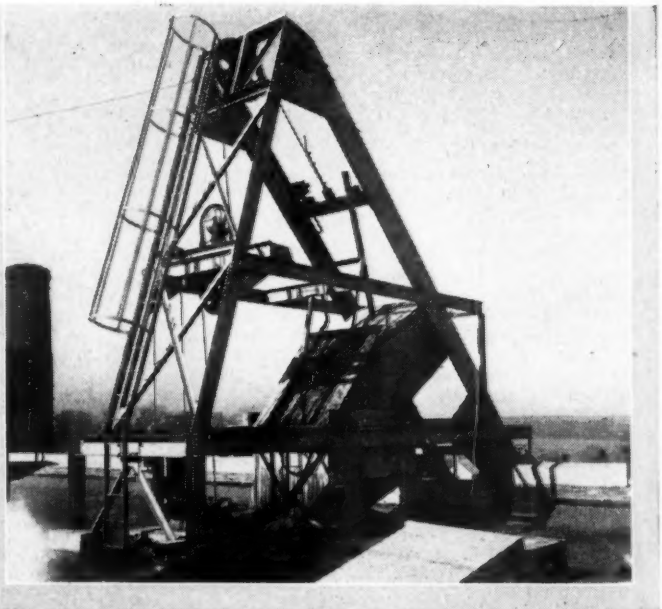
**Above—Illustrating skip hoist on outside wall of power plant.**

**Right—Shows skip hoist superstructure on roof of power plant.**



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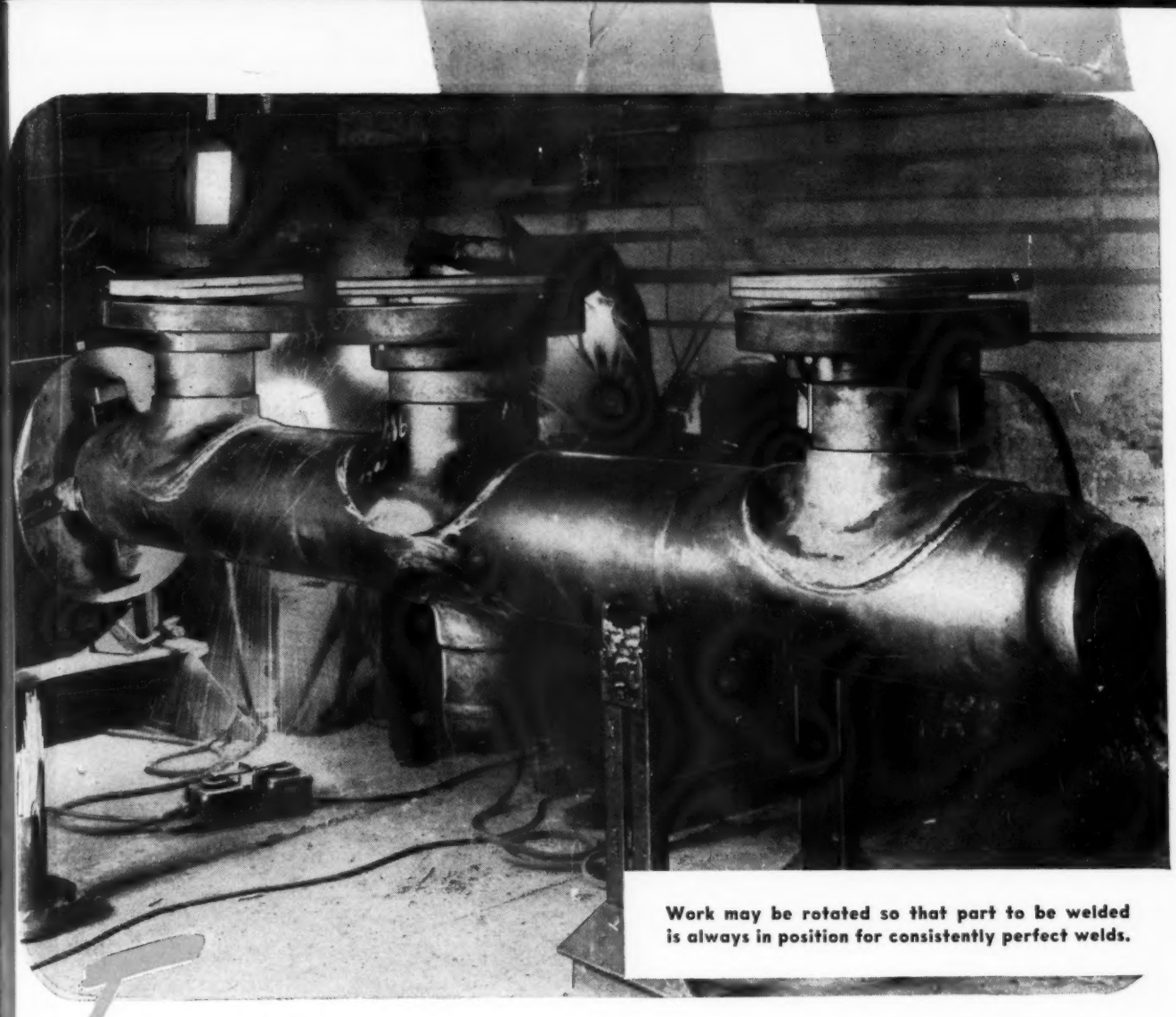

Work may be rotated so that part to be welded is always in position for consistently perfect welds.

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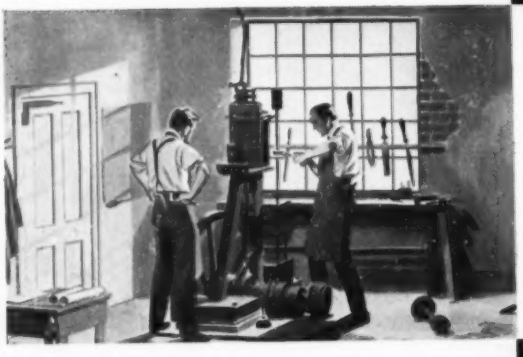

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